GLOBFACT: A Success Factor Framework For Project Management Success in GSD

BY

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To

My parents

&

My Siblings

Moid, Mateen, Moiz, Malik

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I begin in the name of Allah, the Lord of the worlds, known and unknown. To him belongs all the praise and to him belongs all the glory and to him is all the thanks for making me able enough to learn, read, write and accomplish my thesis. Peace and blessing of Allah be upon his last messenger Mohammed (SAWS), who showed us the right path.

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ABSTRACT

Name: Mohammed Abdul Majid Qureshi.

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Global software development (GSD) with its wide expanse across multiple domains of software engineering and large cost impetus, requires a thorough readiness and shrewd planning by the project management teams involved. Many elements are to be considered by the project management team for effective handling of the GSD projects. The success factors presented in this paper are an embodiment of those elements essential and will provide project management teams with the requisite skills for project management success in GSD.

Way-maps and guidelines disparately exist in literature which provides guidance to GSD project teams. This research work amalgamates those disparate characteristics/factors into a single enchiridion and presents as a readiness model to organizations opting global software development for successful project management outcomes.

A two-phased approach was embarked to determine the success factors. Initial phase included, determining the factors via Systematic Literature Review and then suffice it with an empirical study to corroborate the SLR findings. A final case-study was then carried to corroborate our findings and final conclusions are presented as a staged development framework. The findings of this combined SLR and empirical research yield a count of 18 factors which are vital to project management success in GSD. Finally via case-study these factors are implemented as staged levels and presented as a framework.

Assertive and oracular conclusions can be drawn from the findings that the 18 success factors identified are intrinsic to PMGs for their readiness towards global software development. Also practices are provided for each factor to realize those factors and attain project objectives.

Mohammed Abdul Majid Qureshi

ملـخص

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العنوان: إطار عامل نجاح لنجاح إدارة المشاريع في

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. الدرجة العلمية: ماجستير العلوم

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مع فسحة واسعة في جميع أنحاء مجالات متعددة من هندسة (GSD) تطوير البرمجيات العالمية البرمجيات وزخما تكلفة كبيرة، يتطلب استعداد شامل والتخطيط داهية من قبل فرق إدارة المشاريع المعنية. .GSD العديد من العناصر التي يتعين النظر فيها من قبل فريق إدارة المشروع لمعالجة الفعالة لل مشاريع عوامل النجاح الواردة في هذه الورقة هي تجسيدا ل تلك العناصر الأساسية، وسوف توفر فرق إدارة المشاريع خرائط الطريق ومبادئ توجيهية وجود متفاوت في الأدب .GSD بالمهارات اللازمة للنجاح في إدارة المشاريع هذا العمل البحثي تدمج تلك الخصائص المتباينة / العوامل في .GSD والتي توفر التوجيه لل فرق المشروع قائمة ويعرض نموذجا استعداد للمنظمات يختارون تطوير البرمجيات العالمية ل تحقيق نتائج ناجحة في إدارة المشاريع.

وقد شرعت نهج من مرحلتين لتحديد عوامل النجاح. وشملت المرحلة الأولى، وتحديد العوامل عبر

ثم أجريت دراسة الحالة النهائية .SLR منهجية مراجعة الأدب ثم يكفي مع دراسة تجريبية ل بيت هذه النتائج

SLR ل تأكيد النتائج التي توصلنا إليها ويتم عرض النتائج النهائية كإطار التنمية على مراحل. نتائج هذا

مجتمعة والبحوث التجريبية تسفر عن عدد من العوامل الثمانية عشر التي تعتبر حيوية ل نجاح المشروع في

ويمكن .أخيرا عبر دراسة حالة تنفيذ هذه العوامل باعتبارها مستويات نظموا وقدم بوصفه إطارا .GSD إدارة

استخلاص استنتاجات جازمة ونبؤي من النتائج أن عوامل النجاح الجوهرية الثمانية عشر التي تم تحديدها

هي لإبراز مجموعات إدارة ل استعدادهم نحو تطوير البرمجيات العالمية. كما يتم توفير الممارسات لكل عامل

.لتحقيق تلك العوامل وتحقيق أهداف المشروع

محمد عبد المجيد قريشي

CHAPTER 1

INTRODUCTION

1.1 GENERAL

Low cost software development has always been the preamble of many organizations. If this low cost development comes with the added advantage of the high quality product then it adds to increased long term benefits for the organizations[1]. The search for high quality and low cost development has led many organizations to explore new dimensions and techniques for software development leading to trans-geographical mode of development, predominantly termed as Global Software Development (GSD) model[2]. GSD is the process where a company either has its software developed by geographically distributed teams or contracts all or part of its software development activities in return for remuneration[3]. Majority of companies have adopted GSD to gain several perceived benefits such as reduced software development time, access to skilled human resources at relatively low cost and increase in product quality[4, 5]. GSD is significantly changing the economic drivers of software industry due to round the clock availability of skilled personals at lower cost.

Despite GSD benefits, the cultural differences associated with geographically distributed teams and different time-zones have caused problems for GSD based projects[6, 7]. The key GSD challenges are: lack of client involvement, hidden costs, lack of trust among the outsourcing companies, lack of coordination mechanisms and communication issues[8, 9]. One of the major challenges is that many organizations endorse global contracts prior to testing their project management readiness for the global development activity. However, a huge parity exists between the current project management readiness issues and the existing literature review to counter it. We believe that a better understanding of the factors associated with successful GSD project management can assist in improving organizations' project management (esp. in Saudi Arabia) readiness for GSD projects.

Website, researchandmarkets.com reports that Saudi Arabia is the next biggest IT hub in entire middle-east with USD 3.6bn asset worth and expected to rise to close to USD 5bn by 2014. As investment increases in IT and communications infrastructure, outsourcing demand is expected to increase exponentially[10]. An increased outsourcing trend is also expected across various IT organizations in different logistics departments which includes (but not limited to) the company's information as well as inventory systems[11]. However, due to the naivety of global software development scenario in current local IT industry, it remains a nascent field but promises

rich opportunities for many newly formed small and medium scale Saudi IT companies.

1.2 PROBLEM STATEMENT

A literature based review on handling issues pertaining to global software development can shed light on many aspects but only few empirical studies have been themed targeting the outsourcing scenario in Arab world. Therefore an empirical study that estimates readiness of various local IT organizations to global software development is need of the hour[11]. This study is aimed towards substantiating that gap between local IT SMEs and GSD.

The framework presented in our study collocates the factors necessary across various project management dimensions in GSD and then implements these factors as best practices or methods across complex and convoluted project management dimensionalities in GSD. The framework will provide a set of factors which will be identified via a two-step process of systematic literature review and Delphi study, and a set of recommended best practices for the framework will be estimated. These factors, will be presented as a set of best practices (merged into readiness levels) in the form of a software tool in order to facilitate practitioners gauge their current capability in terms of factor possession and effectuate other factors in terms of best practices. This framework will also provide the platform for further

development and up gradation of the complete readiness tool, GLOB along with the added opportunity to researchers world-wide for expanding the research further by collaborations and discussions.

1.3 THESIS OBJECTIVES

"The preamble behind this thesis is to develop a success factor framework, GLOBFACT to assist software development organizations, ingrain a list of success factors via implementation of set of best practices prior to starting global development activities".

In our research, we will identify success factors via systematic literature review and real-world study which will positively impact the success rate of project management group of an organization whence opting for GSD based projects. The process carried out will be a two-phased data amalgamation process where in factors identified from the SLR will be weighed against opinion of industry experts and a set of best practices will be identified for each factor which will ascertain a PMGs(project management group) readiness for GSD. To accomplish the research goal of developing the framework, the research was carried under the aegis of hugely experienced faculty in the field of global software development. Expert opinions were included at every aspect of study wherever (and whenever) necessary, and feedback was provided/received on continual

basis. The overall study was disintegrated into smaller phase-based objectives enlisted below with each phase leading to a tangible outcome relevant to the study and the succeeding phase. The phases and their respective objectives are enlisted below:

Phase-1 Background study & Literature Review:

- Performing background study and initiating systematic literature review.
- Completing the literature review and identifying the factors essential to project management success in global software development.
- Performing a thorough data-analysis on the factors identified from the literature review to answer underlying informative objective questions.
  - Objective 1: What success factors are essentially for project management success in GSD organizations, as identified in the literature?
  - Objective 2: How do these success factors, as identified in the literature, vary w.r.t to various study strategies involved?
  - Objective 3: Do these factors as identified in literature have any relevance to various continents across the globe?

Phase2 Factor identification from the real-world software industry:

- Create a questionnaire based survey to record/ gain experience from industry experts.
- Perform thorough analysis on the opinions garnered from the experts and identify new factors or best practices.
- Use the factors identified via expert opinions to answer the underlying objective questions:
  - Objective 1: What success factors, as identified in the real-world practice, are essential for project management in globally distributed projects?
  - Objective 2: Do these success factors, as identified in the real-world practice, relate to organization's size? If yes, then how?
  - Objective 3: How do these success factors, as identified from the real-world practice, vary from continent to continent?

Phase 3: Comparison of SLR findings & real-world opinion.

- Objective 1: How are these factors as identified from real-world opinion different from the SLR findings.

Phase 4: Case-study and framework development.

- Objective 1: Perform a case-study with an IT organization to validate the findings.
- Objective 2: Based upon all the above findings propose a readiness framework, termed as GLOBFACT

1.4 RESEARCH METHODOLOGY

Our research methodology consists of the following phases:

Phase 1: Literature Review

A systematic and thorough literature review will be carried out to identify the factors essential for project management in global software development.

Phase 2: Analysis of the identified factors

In this phase, we will perform various mathematical and empirical analysis on the identified set of success factors from the systematic literature review phase.

Phase 3: Performing real-world empirical study

In this phase, we will carry out a detailed industry expert opinion based empirical study to validate and comprehend our findings from the SLR and various analysis will be carried on the findings.

Phase 4: Case-study & Framework proposal

In this phase, a case-study will be carried out with an IT organization to validate our findings and a framework will be proposed.

Phase 5: Conclusions

The conclusions of the research are presented. In addition, future directions in the research of factor identification and readiness based development for project management groups will be provided for SMEs and all other IT organizations in general.

1.5 THESIS OUTLINE

The reminder of this paper is organized as follows: Chapter 2 describes the background and provides an overview. In chapter 3, we give an outline of existing works in literature and present case for our study. Chapter 4 describes the research methodology that we have adopted for our research. As this methodology forms the basis of our findings, we describe the methodology in a greater detail. Chapter 5 describes the identified

factors from the literature and the industry-based questionnaire survey. A set of analysis and comparative studies are performed on the results of the SLR and the questionnaire. In chapter 6, all the identified best practices are coagulated and presented as a conceptual framework. To validate the framework readiness, a case-study is also performed. A conclusion is provided and a case is made as to how the findings from this study can be further used in future research endeavors under the final Chapter 7.

CHAPTER 2

BACKGROUND AND OVERVIEW

This chapter presents basics on global software development. Section 2.1 answers a fundamental question specific to our study, what is global software development? The various categories and types of global software development projects are discussed in section 2.2. Section 2.3 highlights the various motivation and risks factors that are involved whence a company is opting for global software development.

2.1 GLOBAL SOFTWARE DEVELOPMENT, WHAT IS IT?

With the advent of internet, a growing trend has been observed towards transition from traditional centralized form of software development to a globalized mode of development where the development cycle traverses software teams, projects or systems which are geographical distant and culturally disparate across various international boundaries. This trans-national mode of development is termed as global software development [12]. In this type of development, the client company contracts out all or part of its software development activities to a vendor company which in turn provides the services for some monetary value[13]. Software

teams located at distant places jointly work on software projects. This increases the efficiency due to the time zone difference as work continuous 24 hours. It also increase success rate as highly trained and experienced professionals from all over the world are hired. GSD enable an organization to produce good products at lower cost with the help of expert and trained employees. The main objective of the organizations to develop software globally is to reduce development costs, select a development team consisting of skilled and professional workers of a diverse background and ultimately increase their market share/value[14, 15].

2.2 TYPES OF GLOBAL SOFTWARE DEVELOPMENT

Due to the vastness in scope of global software development because of its complexity, structure, implementation methodology etc. Global software development is carried out in varied forms across different organizations depending upon their capital and resource capabilities. In many cases, global software development is richly termed as outsourcing. However a more detailed classification as suggested by Khan[16] classifies global software development into broadly two types.

a) Geographic-location based software outsourcing categorization.

b) Relationship based software outsourcing categorization.

2.2.1 GEOGRAPHIC LOCATION BASED OUTSOURCING

On the basis of geographic distance between vendors and clients, outsourcing is categorized into three types: onshore outsourcing, nearshore outsourcing and offshore outsourcing[17]:

- **Onshore outsourcing:** As the name suggests, this type of outsourcing is carried at the same geographic location. In other words this development is a consortium of domestic vendors and domestic clients[8].

- **Nearshore outsourcing:** Nearshoring is a labor-cost based development where the work is transferred to a neighboring country having lower-wage scales.[9]. In the software development industry the term nearshore was first introduced in a story about an entrepreneurial software development venture called PRT that was established in the Caribbean island of Barbados during the years 1995-1998[18]. During this period the word "near" referred to closeness to the United States from geographic point of view while "far" referred to the geographic distance of the client firms in the United States from the Indian vendors. An example of the nearshore outsourcing destination for the outsourcers in the United States is Canada[19].

- **Offshore outsourcing:** This outsourcing is analogous to the definition of global software development that we have used in our project. In simple terms, offshore outsourcing refers to a collaboration where the client and the vendor parties are living or situated in a different geographical location. India, and China in the east, Russia in the north rank amongst noted vendor destinations with Ireland being a new addition to the list whilst Australia, Japan, UK and the United States cover the client list largely[20]. India with its rich IT conducive environment and skill-pool, rates as the most favored outsourcing destination, followed distantly by China[21].

2.2.2 RELATIONSHIP BASED OUTSOURCING

A four way relationship categorization has been suggested by Gallivan and Oh[22] on basis of headcount of vendors and clients involved in outsourcing project. The categorization includes, simple dyadic relationship, multi-vendor relationship, co-sourcing relationship and a complex relationship.

- **Simple Dyadic Outsourcing Relationship**: A simple one to one relationship where in one client contracts all parts of its software to a single vendor who develops the software based upon the single client's requirement. Also if this single client vendor relationship is at a micro/

personal level then it's referred to as microsourcing [23]. This type of microsourcing is usual visible on online open source programming portals where a single user outsources his project to a single vendor for development.

- **Multi-vendor outsourcing relationship**: In a Multi-Vendor Relationship, many vendors are contracted by a single client for various phases of development. Different vendors are answerable to the client for different software development activities. In this type of agreement/contract one client and many vendors are involved who consult each other to benefit from each other's expertise and to settle the outsourcing task jointly[24].

- **Co-sourcing relationship**: An inverse of multi-vendor relationship where in a single vendor is hired by multiple clients for software development. Ideally the collaborating clients have a single or similar software development requirement and hence contract with the same vendor. This scenario is largely observed in vendor companies like Infosys, Wipro etc. situated in India where multiple clients from US, UK contract a single vendor for developing a common software product.

- **Complex Outsourcing Relationship**: As the name suggests, it's the most complex outsourcing hierarchy with a combination of multiple vendors and multiple clients working towards a common software solution. As

the headcount of the clients and vendors increase, the complexity of the system increases and it becomes essential to have a centralized project management group to control the entire project cycle. A common project management group is practically not feasible as different clients have different work protocols and ethics. Hence complex outsourcing relationship might lead to failure if not properly controlled and monitored.

The following figure as projected by Khan et al. summarizes the various types of global software development techniques[16]:

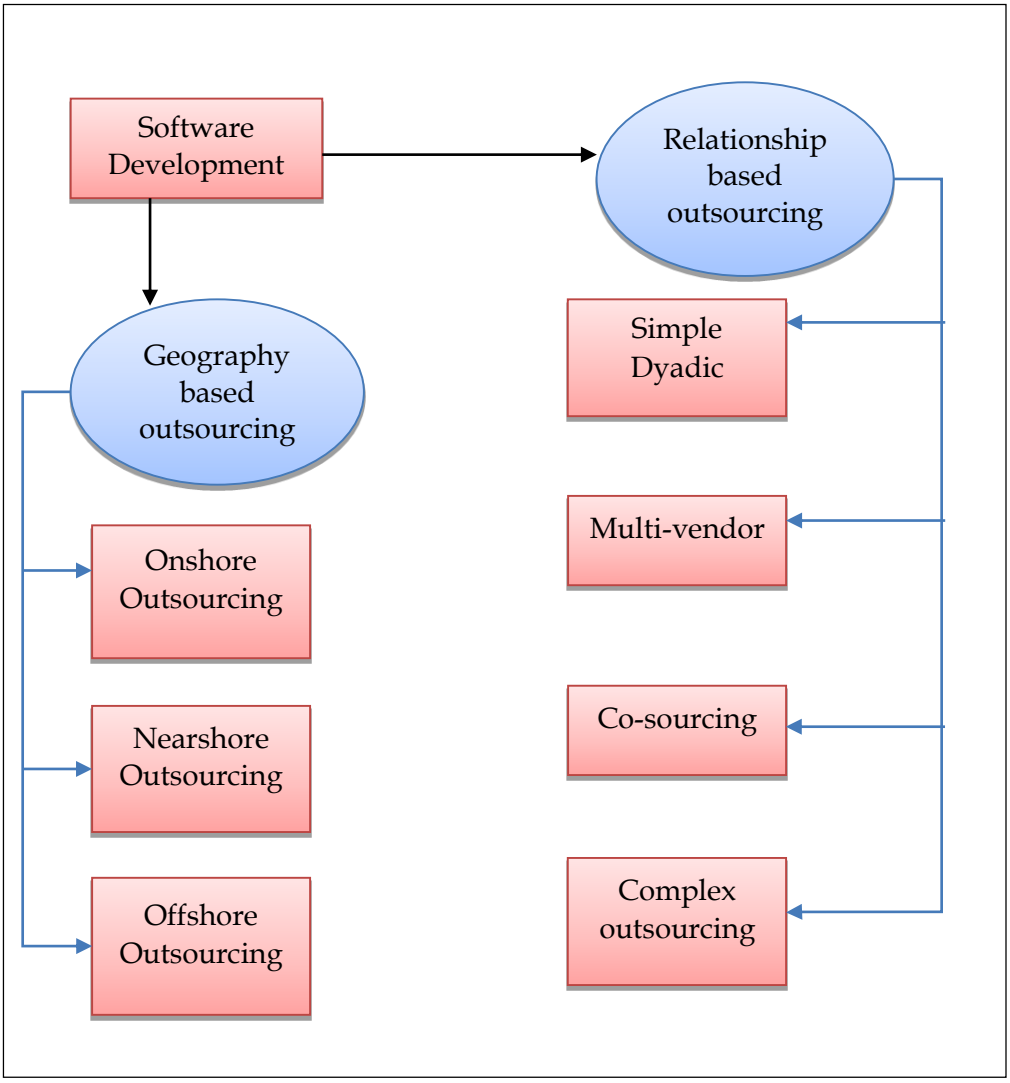


Figure 2.1 various types of outsourcing techniques[16]

CHAPTER 3

LITERATURE REVIEW

Global software development is driven by my motivation factors (primarily economical in nature). However there are many risks (primarily temporal in nature) involved in opting for GSD. The following section describes the various motivation and risks factors specific to GSD. Section 3.2 summarizes the previous studies carried out in literature covering many aspects of GSD.

3.1 MOTIVATION & RISKS OF GSD

Quality and cost are the two primal reasons for organizations approaching the haloed portals of global software development[25]. Distances are reduced due to collaboration of teams from varied geographic locations and allows for access to a more talented workforce with the added attraction of low-cost development[26]. Another claimed benefit of GSD is nearness to local market or customer reduces the time-to-market and parallel development across various geographical locations enables a round-the-clock development[27]. Development costs remains the most vital characteristic which propels organizations to employ global

development techniques even though they are aware of various intrinsic risks involved[19, 28, 29]. The driving force in global software development is the benefit of low-cost development acquired by moving development to low-wage scale countries with comparable skill level[30]. Teams working in different geographic locations under different time-zones give a pseudo effect of a single team working for 24Hrs. This results in an increased work efficiency (estimated per day) and reduced development time or incremental cycle. This strategy is more famously termed as follow-the-sun strategy and richly credited as a significant GSD benefit[31]. Even in cases where one team performing development is off the day-work, the development team at other geographic location is developing the product thereby doubling the efficiency at least in theory[32]. The nature of GSD forces teams to split their work into well-defined individual modules, which is beneficial to the overall development as these can be developed in parallel. Another largely accepted/known advantage of opting for global software development is the accessibility to the large pool of highly skilled labor resources; predominantly in countries like India and Malaysia[33, 34]. Personnel involved in GSD come from various backgrounds and varied skill levels providing GSD organizations with an added advantage of larger talent pool and experience levels[19, 28]. A lesser known but significant advantage of GSD is by establishing subsidiaries in countries and on

continents where one's customers are located, a more direct interaction becomes possible[33].

Deemed advantages and risks involved in opting for global software development go hand-in-hand. Situations have risen in the past where the overall development costs incurred in outsourced development have been significantly more than in-house development methods due to poor project management practices. Poor communication between project management teams across various locations with the centralized project management group have resulted in huge lacunas in requirement understanding and implementation by vendor teams[35]. Not only are the development costs involved in global development huge but also long-term maintenance costs require a wholesome commitment from the project management team for sustained project completion and maintenance.

For successful project management in global development system, all the processes and tasks need to be streamlined according to the skill levels and potential of the teams at various geographic locations. This calls for sound and astute project management practices and experienced project management professionals[32]. Whilst offshore sourcing activities are beneficial yet they are not risk free and are susceptible to many failures[36]. Islam et al, [31] credit ambiguous client requirement, poor client-vendor understanding and irresolute development process as major reasons of

project management failure in GSD. The results of a survey shows that eight out of every ten firms that have outsourced their software development project to an offshore vendor have faced major problems due to insufficient preparation and poor management by both the vendor organizations[37]. Nam et al, [38] report that more than 36 clients (out of 98 investigated)expressed their desire to stop working with vendors on offshore projects. Christel and Kang[39] report more than ten issues that are intrinsic to requirement specification failure while opting for GSD projects. Tang and Joshua [40] report the effects of poorly skilled project management persons leading to failure of Boeing 787 Outsourcing project. King[41] reports that JP Morgan decided to perform in house many software activities that it previously outsourced, and did not renew its $5 billion contract with IBM. Due to various types of outsourcing as enlisted in the previous chapter, it involves developing a complex project development model depending upon the scope of the project. This complexity results in high coordination costs[42], information security problems[43], lack of direct communication[34], and perceived loss of expertise in the outsourced activity[44], cultural misunderstandings[22] and infrastructure problems[28]. Language barriers, geographical risks, trust, security concerns and unexpected/hidden costs are additional risks involved in global software development.

3.2 PREVIOUS STUDIES IN LITERATURE ON PROJECT MANAGEMENT IN GSD

The following section is an amalgamation of the key studies carried out in literature on global software development. The idea is to summarize each study's findings and then present the current problem context.

- Oza[20] conducted a study at Hertfordshire University, UK to understand the logics behind managing offshore outsourcing relationships and then built a model for managing offshore relationships as a proposed output. However this study was limited to only vendor destinations in India while the clients were US and EU.
- Another study concerning Vietnamese vendors and clients from States and EU was conducted by Nguyen et al. [45] This study shed light on the Vietnamese vendors' perspective on developing and maintaining trust amongst foreign clients.
- Another study specific to trust building was undertaken by Sabherwal [46]. Where-in he identified trust development activities via case-studies for clients based in West and Oman while vendor organizations resided in India and Columbia.
- Rajkumar and Dawley [47] studied vendor industry in India and their US based clients to establish a fair picture of multiple outsourcing

characteristics like risks involved, assumed benefits, and market conditions. Another study aimed only towards risk and benefits involved with outsourcing projects in India from UK based clients was performed by Khan et al.[48]. Another risk determination oriented study was performed by Sakthivel [49] . In another study, Charalambos and Robbie [50] have attempted creating risk based profiles for vendor organizations in India for clients located in USA.

- Project management based approach finds a mention in the study by Narayanaswarmy and Henry [51]. Culture is primed as the critical factor for controlling project in the research model proposed by them [51].
- A cost control and minimization based framework was suggested by Aubert et al. [52] to attain contract completeness. An empirical study has also been presented to validate their findings.
- Burney et al. conducted a study to understand requirement based factors and priorities for a company competing with big organizations on global development front[53].
- Jahns et al, [54] have reviewed the literature to investigate the term offshoring and its driving forces on the environmental and company level. The impact of four environmental segments is widely explored. These segments are economic, political-legal, socio-demographic and technological driving forces.

- Chou et al, [55] have worked on outsourcing relationships. Based on case study at Taiwanese large sized organizations various pre-contractual relational ties were identified. These relational ties have been categorized into technical source ties, capital funding ties, human capital ties and business interdependencies ties. They argue that the vendor's prior knowledge and experience in outsourcing projects along with the vendor's prior relationships with client organization play a vital role in the success of outsourced projects.
- Hanna and Daim [56] have conducted two interviews, based on a literature survey for outsourcing management practices, with decision-makers in two organizations. The aim was to investigate best management practices for successful outsourcing relationship. The study identified trust and security as the critical success factors in successful outsourcing relationships.
- Barney et al. [47] conducted a study to identify factors regarding different companies' requirements and priorities in software development to compete in the domestic and global software development market.

Above highlighted studies hint towards a focus on relationships that exist among outsourcing parties and the trust issues involved amongst these parties. Statistically speaking, only a few companies have been able to utilize the full potential of global software development[57]. These frequent

failures in GSD can be attributed to a plethora of reasons [58-60]. One of the major issues is that many clients endorse global contracts with their vendors prior to testing their project management readiness for the global activity [57, 61]. For example, a recent Systematic Literature Review concludes that the Global Software Engineering field is still nascent and comparatively fewer empirical studies have been conducted in order to provide solutions to the problems in this domain [62]. "The majority of the studies represent problem-oriented reports focusing on different aspects of GSE (Global Software Engineering) management rather than in-depth analysis of solutions for example in terms of useful real-world practices or techniques" [62]. Unfortunately only little has been said or done in literature to improve organizations' project management readiness for global software development. Understanding issues relating to organizations global project management readiness will help realize successful project outcomes [63-66].

3.3 SUMMARY

The following chapters have been documented, motivated by the factors that are conducive to GSD and the risks that need to be overcome. However the primary focus of the study will be aimed at identifying the factors which are specific to project management teams handling GSD projects. First a literature review will be carried out followed by real-time industry study to evaluate the findings and propose a framework.

CHAPTER 4

METHODOLOGY

4.1 INTRODUCTION

In this chapter the research methodology adopted for our study is presented. In order to address the research questions described in Section 1.5, we adopt a two-phase approach. First one involves the use of Systematic Literature Review technique for identifying project management success factors from the literature while the second phase will be industry oriented, where-in we will validate our findings from the literature based upon opinion of industry experts.

4.2 SYSTEMATIC LITERATURE REVIEW

A systematic literature review approach was implemented for a comprehensive coverage of the entire literature. Systematic literature review was purported by Kitchenham et al. [67] In contrast to a normal literature review, a Systematic Literature or an SLR (more commonly known) is structurally planned and methodically executed. It provides a step based approach with steps ranging from initial findings to final

filtering of studies there by providing a detailed and a compendious view of the literature. Also it provides for validating the findings via assessment technique. The basic steps in an SLR include the following:

- Breakage of the research string into manageable search terms.
- Tailoring the search string according to the different literary databases.
- Applying a selection process and selection criteria to filter the findings.
- Applying Study Quality assessment.
- Creating Data Extraction form for data amalgamation.
- Creating Data Synthesis form for data analysis.

4.2.1 SEARCH STRATEGY

Our research questions are subjective in nature. A general search on this type of research questions leads to an exhaustive set of results on all databases (as all the databases implement search algorithms containing text-based metadata search). To make things simpler and obtain more coherent search results, we employ the search string breakage technique as suggested by Kitchenham et al. [67]. In this approach, each research question is divided into sub-parts and combinations of these sub-parts along with their synonymic grammar is put as keywords into the literary database. The search strategy has been based on following steps:

- Derive the major terms from Population, Intervention and outcome.
- Find synonyms and similar spellings of the derived terms obtained above.
- Verify these terms in various academic databases
- Use Boolean operators (AND operator is used to connect major terms (if allowed). OR operators, is used to connect synonyms and similar spellings. (If allowed).

Based upon above search strategy, the research question is broken down into sub-parts namely population, intervention, outcome of relevance, and experimental design.

- **Population:** Global software development projects, global project management, software project management and GSD.
- **Intervention:** Project management factors
- **Outcomes of relevance:** Factors for successful project management of GSD
- **Experimental Design:** SLR, Data Synthesis, Industry experts' comments.

Application of the previously specified grammar to our research question results breaks the research question into sub-parts as follows:

Research question: [What are the factors contributing to success?]

INTERVENTION

[Of project management]

POPULATION

In

[Global Software Development]

OUTCOMES OF RELEVANCE

We test our terms in various academic databases and the following terms show potential relevance to the topic:

- ***GLOBAL SOFTWARE DEVELOPMENT:*** Global Software Development OR GSD OR distributed software development OR multisite software development OR multi-site software development OR global software teams.
- ***PROJECT MANAGEMENT:*** Software Project Management OR Software Development Management OR Software Process Management.
- ***FACTORS:*** Factors OR causes OR agents OR elements OR aspects OR determinants OR constituents OR ingredients.
- ***CONTRIBUTE:*** Contribute OR furnish OR provide OR supply.

- ***SUCCESS:*** Success OR advance OR progress OR favorable OR effective.
- ***IMPLEMENT:*** implement OR apply OR utilize OR device OR mechanize.
- ***PRACTICE:*** procedure OR form OR method OR perform OR exercise.

The final search string is a combination as follows:

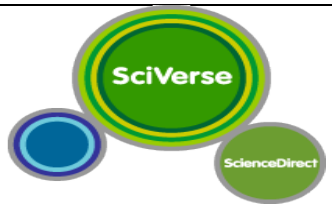
{Global Software Development OR GSD OR distributed software development OR multisite software development OR global software teams}

AND {Factors OR causes OR agents OR elements OR aspects OR determinants OR constituents OR ingredients} AND {Contribute OR furnish OR provide OR supply} AND {Success OR advance OR progress OR favourable OR effective}

4.2.2 DIGITAL LIBRARIES

Based upon the availability of access and the context of our research questions, following set of online digital libraries were used (any other reference made to any study outside these libraries is duly mentioned at the reference location itself).

Table 4.1 Digital Libraries Used

Library Used	Link
ACM Digital Library	
IEEE Xplore	
Science Direct	
Wiley Online Library	
Springer Link	

Each library accepts input strings in different style or combination keys. The generic search string was tailored according to each database and relevant studies were identified. Whilst constructing the string combination, a preceding search criteria was applied and only those studies that follow the succeeding set search criteria were shortlisted for further study.

4.2.2 STUDY SELECTION CRITERIA

For the various digital libraries included, various inclusion and exclusion criteria were identified. The use of these criteria is to narrow down the search but at the same time refine it ample enough as not to miss any study that is relevant to project management success in GSD.

- **Inclusion Criteria**: This would include the set of papers that will be considered for data extraction. Various papers discuss about factors for success in GSD projects in general however only those papers have been selected which discuss success factors only related to project management. In general, selected studies included the following:

  - ✓ Studies that describe the success factors of project management in Global Software Development.
  - ✓ Studies that describe the best practices of implementing these success factors in Global Software Development.
  - ✓ Studies that may provide empirical basis for its findings.
  - ✓ Studies that describe about effective project management in Global Software Development

- **Exclusion Criteria**: All studies which discuss GSD issues in general have been excluded to refine the scope. Studies related to GSD setup for

student learning processes have also been excluded as they are not a proper guide to project management specifics, for example:

- ✓ Studies that is not relevant to the research questions.
- ✓ Papers published before 1980 are excluded since Internet starts after that date.
- ✓ Manuscripts written in non-English language is excluded.
- ✓ Poor English writing papers are excluded as it may cause ambiguity.
- ✓ Pure psychology or motivation studies are rejected.
- ✓ Papers that show adoption of collaboration tools in a single department are excluded
- ✓ Technical reports, and white papers are excluded.
- ✓ Graduation projects, mater thesis and PhD dissertation are excluded
- ✓ Textbooks whether in print or electronic are excluded from this systematic review.
- ✓ Studies in other domains of knowledge like civil engineering projects are excluded

4.2.3 STUDY SELECTION PROCESS

Studies shortlisted after applying the inclusion and exclusion criteria are keyed into various digital libraries to get a repository of relevant studies. To increase more granularity, a study selection process is carried out where-in each study or paper is individually studied. In the initial phase, all the papers with irrelevant title and abstract were omitted. The second or the final phase of study selection process formed the gist of the analysis process where the complete text of the filtered studies (after initial selection) was reviewed. Once the final selection was carried out, a quality score metric was designed to gauge the quality/relevance of the final studies to the research questions. Also to remove human-bias and error, inter-rater reliability test was performed on studies in both (initial and final) phases.

For any paper to pass the selection process, a quality assessment was done. Four quality criteria were prepared as shown in the following table. The answer to each of the above mentioned question is assigned a score of 1 for 'Yes', 0 for 'No' and 0.5 for 'Maybe'. This implies that higher the overall score a study obtains, the greater is the quality of the study. The results of the quality assessment study were used to limit the selection of literature.

Table 4.2 Study Quality Assessment

Criteria	Score	Notes
Are the findings and results clearly stated in the paper?		Yes =1 No =0
Is there any empirical evidence on the findings?		Yes =1 No =0
Are the arguments well- presented and justified?		Yes =1 No =0
Is the paper well referenced?		Yes =1 No =0

After applying all the refinement techniques stated earlier and the study quality assessment criteria as discussed above, a total of 118 studies were short-listed from the complete pool of study repository available. The following table gives a count of the initial and the final studies shortlisted.

Table 4.3 Study Count

Resource	Total Results	Initial Selection	Final Selection
IEEE Xplore	639	238	92
ACM	29	14	7

Science Direct	27	10	4
Springer Link	28	13	7
John Wiley	31	17	8
Total	754	292	**118**

To answer our research questions, we extracted data from the final studies using the data extraction forms, (applying protocol) suggested by Kitchenham et al. [67] The following data was extracted from each paper:

- Publication type
- Authors
- Publisher
- Publication name
- Publication date
- Organization size
- Project size
- Success Factors identified
- Any relevant best practices

The total number of articles retrieved after using the search terms in the five electronic databases are shown in Table 4.3. After the initial round of screening by reading the title and abstract, 292 studies relating to five different electronic databases were selected. After full text readings in the second screening 118 primary studies were finally selected. The number of

factors identified from every single study has varied considerably. The table below gives a synopsis of the form which was used for data extraction. A screenshot of actual excel sheet has been added in the Appendix for reference purposes.

Table 4.4 Data Extraction Form

Data Item	Value	Supplementary Notes
Study Information Data		
Paper ID		
Date of Review		
Title		
Author(s)		
Year of publication		
Reference type	Journal/Conference/Thesis /Unpublished	
Type of Study	SLR/Interview/Case Study/Report/Survey	
Publisher		
Data Relevant to Answering Research Questions		
Factors contributing to success of project management in GSD		
Best practices implementing these factors in project management		

Once the data was extracted in the form shown above, it was synthesized to identify the factors and related best practices from each paper using the data synthesis forms as shown in the following table:

Table 4.5 Data Synthesis Form1 Paper and related factors

RQ1: What are the factors contributing to success of project management in GSD?						
Paper ID	Quality (score)	Population (e.g. project management)	Geographical location	Yearof study	Typeof Study	Factors contributing to success of project mgmt.

Once the data was synthesized, it was refined further to obtain a count of the number of times, a factor occurs in all the papers. This refinement was essential in carrying out analysis especially for use with SPSS Statistical Analysis tool. The format used for statistical analysis is as shown below:

Table 4.6 Form2 for SPSS Analysis

RQ1: What are the factors contributing to success of project management in GSD?		
Success factor 1 (identified in form 1)	#of papers	Notes (if any)
Success Factor 2(identified in form 1)	#of papers	
Etc...		

Once the synthesis was performed, a total of 18 critical success factors which are essential to project management success in GSD were identified. A comprehensive view on these factors is presented in the next chapter. Once the factors were obtained, there were rated against industry experts' opinion via a Questionnaire Survey.

4.3 DATA COLLECTION VIA QUESTIONNAIRE SURVEY

Based upon the scope of the research questions and their findings identified by systematic literature review, a questionnaire/survey was prepared and distributed via social media forums like LinkedIn, Facebook, Global software development forums and other industry contacts, amongst various industry professionals ranging from entry-level developers to project managers working across several software and project management domains like Windows based, Data processing, Real-time Systems etc.

A survey research method is considered suitable for gathering self-reported quantitative and qualitative data from a large number of respondents. A questionnaire was developed using the Google Forms tool available online and is largely based upon the questionnaire developed at Keele University UK [67]. The use of the online questionnaire had the added advantage of storing responses in an excel sheet for later analysis and reference. The overall questionnaire was divided into three sections/part

with each section corresponding to data on demographics, factor rating and related best practices respectively. The questionnaire at the same time being subjective w.r.t earlier SLR study was also open-ended in nature, there-by providing the respondents/experts to provide any more information relevant to factors for project management which might have been overlooked during SLR study.

4.3.1 DATA RESPONDENTS

A total of 46 responses were recorded against the 18 factors identified via SLR and a set of 178 best practices were purported by these practitioners. Each factor was rated against its relevance to project management success in global software development by the practitioners based upon a 5-point rating system.

- Strongly Agree,
- Agree,
- Disagree,
- Strongly Disagree,
- Not sure.

The demographics of the respondents have been safeguarded on a prior agreement basis and will not be revealed to anybody except the questionnaire piloting researchers. However the results of the survey and the analysis will be provided to all the respondents who have willingly provided their email contacts to learn about the results of the study. A screenshot of the questionnaire used for industry experts' opinion collection is presented in the appendix.

4.3.2 INDUSTRY DATA ANALYSIS

The data obtained from the industry was organized into data groups or sets and frequency estimations were done to mathematically assess the data values (as it was available in descriptive form). The frequency tables will be used to report the counts and occurrence frequency percentage of each data variable (factor in our study).

Because of the nominal/ordinal characteristic of the available data, frequency analysis was used for cross group comparisons (especially comparison across SLR and industry data). Detailed factors list, comparison of SLR factor with their industry study counterparts and weightage of each factor w.r.t other factors is presented in the next chapter.

CHAPTER 5

FINDINGS & DISCUSSION

5.1 INTRODUCTION

In this chapter we present our findings from the systematic literature and the industry study. The chapter is categorized as follows. In the succeeding section, we answer our research questions and objectives stated under Objective 1, Objective 2, and Objective 3 for phase-1. Then the succeeding section will cover Phase-2 objectives. Finally in the last section of the chapter, we will compare our findings from the phase-1 and phase-2 and present those findings under phase-3 as shown in flow-chart below:

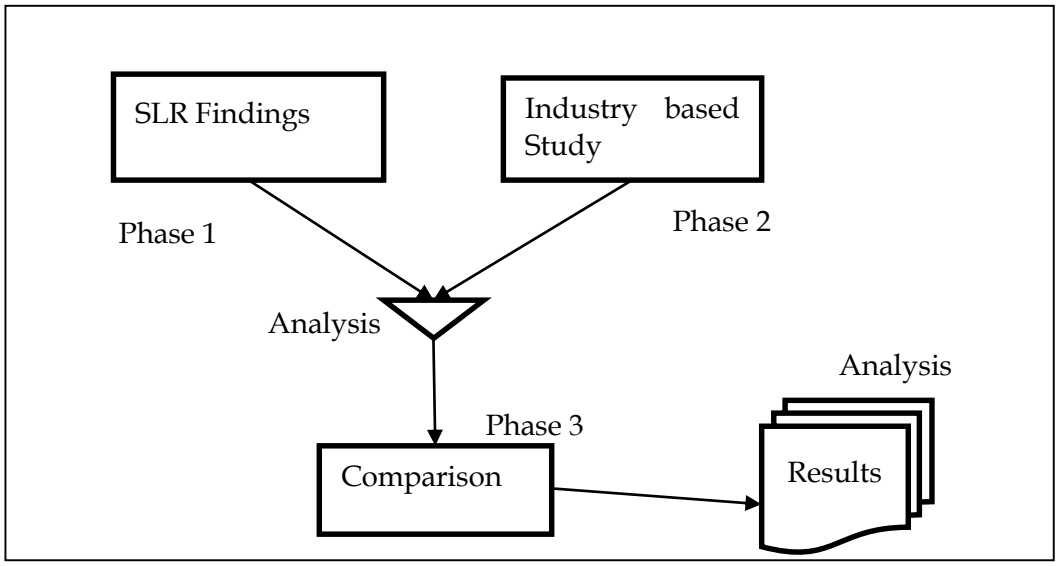


Figure 5.1 Phase-wise objective completion

5.2 PHASE-1: OBJECTIVE 2:

IDENTIFIED SUCCESS FACTORS & THEIR OCCURRENCE IN LITERATURE

A total of 118 studies were shortlisted by using the study selection process, we have described in the previous chapter. We have finalized a total of 18 factors from these studies. Initially a list of 26 factors were determined but later-on, on further refinements, assessment and project management domain experience of the people involved in the study, a few factors were discredited as critical to project management success, while a few were merged into a single essential project management functionality.

Hence what we present in the following table is a refined, merged and synthesized list of 18 success factors which are vital to success of any project management group for a company opting for global software development. A list was compiled based upon the frequency of occurrence of each factor in the studies undertaken either (directly or indirectly). Situations have arisen where-in a factor or a couple of factors have rarely been discussed or sparingly discussed in some studies but these factors are also vital to project management team's success in handling GSD projects. Care has been taken

to merge these factors into a single coherent factor which encompasses all these significant but sporadic project management characteristics.

The following table shows an exhaustive list of all the factors identified, rated against their frequency of occurrence in the 118 studies. The list is,

Table 5.1 Factors & their frequency of occurrence

Factors	**Freq. (n=118)**	%
Organizational structure	73	62
Project managers' skills	69	58
Communication	64	54
Requirement specification	48	41
Cultural awareness	47	40
Trust building	41	35
Collaboration	40	34
Work dynamics	38	32
Shared Knowledge	34	29
Team commitment and structure	31	26

Time-zone difference awareness	27	23
Cost assessment	23	19
Roles and responsibilities	17	14
Shared goals	14	12
Customer awareness	11	9
Training	10	8
Time to delivery	9	8
Incremental cycles	7	6

Based upon the frequency estimates the top factors that have been identified are:

- Organization Structure
- Project Management Skills
- Communication
- Requirement Specification
- Cultural awareness

5.2.1 ORGANIZATION STRUCURE:

The most common factor identified through SLR with an estimated frequency of 62% i.e. 73 papers is organizational structure. Organizational structure basically includes a modified 4 P dynamics i.e. product, project, people and place. On global development front, the organization is variably characterized based upon the project scope and location. Different projects are managed globally using different techniques[68]. For example the figure below as described by Binder shows a UK based project where all the project managers are locally based in UK, however the scope of each Project Manager is differently and based in a different geographical location. A UK-based PM controls the software tool development being carried out concurrently in Singapore, UK and Mexico.

While the pilot project implementation is carried out in UK and other implementations are distributed geographically across locations like UAE, Mexico, Singapore and Canada. This type of organization structure calls for a cognitive architecture where the people (PMs located in UK) are hugely experienced in handling trans-continental development and implementation; the process (simultaneous development and implementation in UK, Mexico and Singapore) is standardized and progressive; the product (implemented across four continents) is robust and the places (UK, Singapore, Canada, Mexico and UAE) are conducive to

product development and successful implementation. As organizational structure is a cluster of all these entities, it's the single most important factor to be considered for project management success in GSD.

Managing teams virtually across the globe, defining task schedules, diving responsibilities amongst teams based upon capability quotient, are primal to a cognitive organizational structure as expressed by Edwards et al. [69]. Product architecture management and phase-wise project development using appropriate architecture are mentioned as essential organizational structure constituents by Noll et al. in their study [70]. Morten and Shashi view organizational structure is viewed as a people-oriented entity where in the robustness of organization's structure is directly measured based upon the visible contribution of all the people involved in the project development [71].

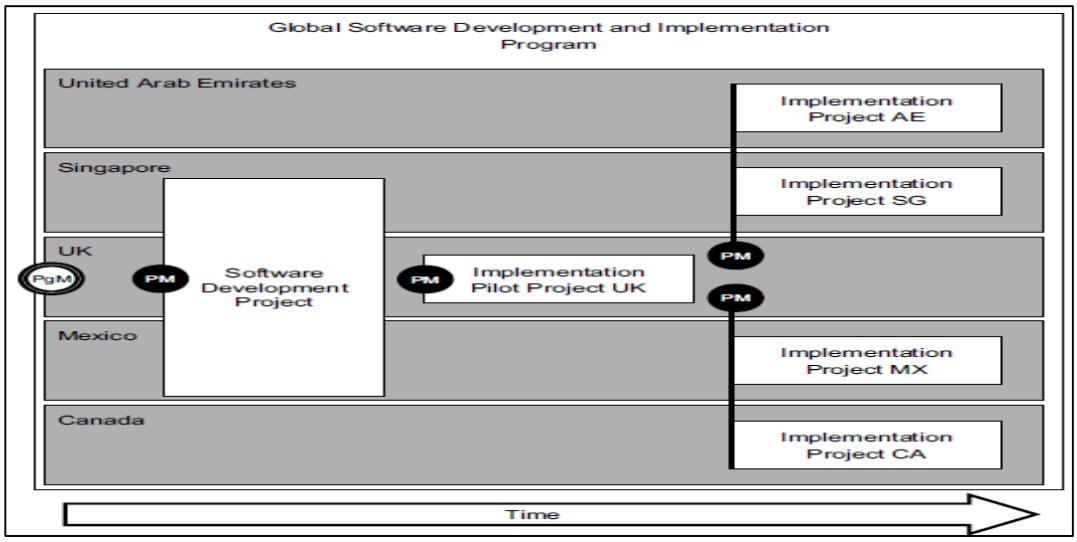


Figure 5.2 Local program of global projects

5.2.2 PROJECT MANAGER SKILLS

Another essential factor, vital to project management success and cited by more than 58% of the studies is the project management team involved in the GSD project. The project management team as shown by earlier diagram cited by Binder constitutes a program manager, project manager, and onsite-coordinator, each having variable skills and expertise in handling GSD projects. From figure 5.2, it can be observed that a PM located in UK is handling concurrent project development across Mexico, Singapore and UK. This kind of skill calls for huge experience and project management cum controlling skills[72].

Blaszczky, T. in his survey on operations research tool has cited strong quantitative aptitude, risk and cost, asset management amongst other skills like experience essential to being a project manager on a global development scale. A project manager is expected to complete project in-time, in-budget and satisfy all requirements at the same time being transparent to higher hierarchy. Jugdev defines project management as a strategic asset.

Other studies by Hobday et al. and Zika et al. respectively express multi-project managements as an essential trait of project managers in a

GSD (these projects may or may-not be interdependent in nature) environment.

Another ability of project managers cited by Larson and Gobeli is the ability of the project managers to pull out resources from a functional or a matrix type of environment. Moreover the project manager's prior experience holds a prominent and imminent role on project success.

Mary and Joseph in their study on the impact of client projects on project managers discuss various skills that are requisite for a project manager handling GSD projects [73]. These skills include amongst others, a vast training experience of the project, vendor awareness and knowledge by the project manager as well as the project management group, business relations with vendor project management teams and understanding, project manager awareness of the project knowledge transfer procedures, schedule meetings, objective delivery dates, cost and risk understanding of the project. A pattern for understanding the project management group responsibilities is expressed by Välimäki et al. [74] in their study where-in they ascribe project managers with responsibility of handling the project change control board (PCCB) both on the client as well as the vendor side. Other responsibilities expressed are streamlining timelines and schedules of the project [74].

5.2.3 COMMUNICATION

The factor, 'communication' (54%) is the third frequently mentioned success factor in our study. Since the development sites are spread across geographical boundaries, communication between different sites is very important. Different studies have described the impact of communication on GSD projects: Tsuji et al. concluded that communication capabilities have a significant impact on the results of GSD projects; Ericksen and Ranganathan described the case of one offshore software development outsourcing project which completely failed due to the lack of adequate communications.

Communication is generally of two types i.e. synchronous and asynchronous. By synchronous communication we mean face to face meetings and discussion with team members and client. As GSD is different from a collocated development due to the geographically distributed teams communicating face to face is not possible unless team members travel between development sites. Lack of face to face meetings can impact on other project management challenges like misunderstanding of requirements, lack of team awareness and lack of trust in GSD. Hence, GSD relies on other synchronous and asynchronous communication channels such as e-mail, voice mail, instant messenger, teleconferencing and web conferencing to promote communication.

Dr. Benedikt Lutz's case-study[75] on communication and linguistic challenges in GSD projects highlights various attributes which commune into single essential entity, 'communication' as a vital factor to project management success in GSD. These attributes include various types of communication like requirement based communication, communication for knowledge sharing, integration based communication, discussion based communication, communication via local language, communication via synchronous media and asynchronous communication.

Another study by Tony et al. [76] provides many facets of communication which include but are not limited to face to face communication via electronic boards, video-conferencing devices, file sharing e-boards, recording meeting minutes, communicating future milestones, acknowledging accomplished objectives, and communicating project status to all teams across project dimensions.

Emam et al. [77] stress on documented type of communication as essential means of control for the project management team. This include communication of availability of training and help documents for entire project to all teams, team gathering meetings documentation, project progress documentation, asynchronous mode of communication etc.

5.2.4 REQUIREMENT SPECIFICATION

Requirements specification factor has been mentioned by 41% of the articles. We consider requirements specification important because it is an official statement of the system requirements for customers, end-users, software-developers, system test engineers and system maintenance staff. Indeed, the requirements document can act as a contract between customers and developers. The key to requirements specification is to present the idea of a shared understanding. In other words, all parties should be able to read this document as if it is their own.

5.2.5 CULTURAL AWARENESS

In our study, 40% of the articles have mentioned 'cultural awareness' as one of the project management success factors in GSD projects. This is due to the fact that in a global software environment the development sites are spread across the globe which invites cultural challenges for the project manager to handle. Due to cultural differences it is always difficult for both the client and vendor organizations to communicate with each other as the native language will, generally, not be the same. Messages can be misinterpreted by different cultures which can cause confusion and misunderstandings between different teams. Hence, we can deduce that

cultural awareness can improve other project management success factors such as communication and trust etc.

L. Fernandez et al. [78] in their analysis of cultural influence on GSD projects and project management teams, stress on improving cultural understanding techniques like cultural meets, effort towards giving importance to collaborative teamwork especially across differently cultured teams, promoting cross-cultural development, enforcing cultural understanding improvement skills, cross-cultural team discussions and recording the minutes of the discussion and analysis project progress.

Dexia Ziang[79] in his efforts on evaluation of competing Chinese firms for GSD projects, categorizes various factors as either macroscopically significant in project management success amongst which he rates cultural understanding and awareness as critical. According to his study, understanding of local culture is essential to gauge the local political environment, customer preference, legal issues etc. which play a significant role in shaping the projects future especially on the vendors' side where most of the project development is being carried out.

Another marked study on understanding cultural lacunas was carried by Valentine Casey and Poole Dorset[80] where the stress on the importance of leveraging cultural distances and uncertainty by rationalizing collectivity over individualism, long-term considerations over short-term objectives.

5.3 SLR BASED ANALYSIS

Similarly various other studies express opinions with regards to the different factors that have been enlisted in table 5.1 shown above. Once the factors were obtained, a series of analysis were performed on these factors to answer our research objectives and determine the robustness of these factors in answering project management groups' puzzles. However before jumping to our analysis, we present the methods we have used for our analysis. In the sections, 5.4 and 5.5 we present tables with chi-square characteristics performed on them. The rationale behind using Chi-square analysis and specifically linear-by-linear association will be explained after a brief mathematical primal on Chi-square statistics in the following section.

5.3.1 CHI-SQUARE STAISTICS: A PRIMER

Chi-square statistics is used for comparison between expected frequencies and observed frequencies. The comparison is used to identify how co-related or disparate, two non-comparable entities are with regards to some common characteristic. Mathematically it's defined as the summation of the ratios of, the squared difference of expected frequency (EF), and observed frequency (OF) and; the expected frequency (EF) for an entity. To put in a formula, it is

$$\chi^2 = \sum [\frac{(OF - EF)^2}{EF}]$$

Whence, the chi-square value is calculated, it's used to estimate the significant difference between two entities. This significant difference between the two entities is called as p-value and it signifies who similar or disparate two entities are over a common characteristic. The chi-square characteristic runs based upon a, Null hypothesis and a Research hypothesis.

Chi-square statistics finds a relevance in our study because we are trying to gauge how each entity (a study type, a geographical location, organizational size etc. in our study) varies with respected to other entities (other study types, other geographic locations, other organizational sizes) with regards to a common characteristic (the success factors in our case). Here each success factor will become a characteristic and study type or geographic differences/similarities are determined.

Also to be noted is a fact that all the entities that we have in our analysis are subjective in nature i.e. there is no pre-defined numerical value or quantity associated with each entity hence for experimental purposes we make our data ordinal in nature i.e. some arbitrary but fixed value is assigned to all entities for a particular characteristic.

For example, if a particular factor (characteristic) occurs in a particular entity (say a study type like SLR), then the ordinal value for a study of type SLR and containing discussion about that factor is 1 (meaning YES) or else its 0 (meaning NO). With these concepts in mind, we perform our analysis in the following sections.

5.3.2 FACTORS INFLUENCE W.R.T STUDY STRATEGIES

A range of studies varying from case-studies to SLRs were included in the current SLR which are commonly used in the empirical software engineering, as shown in Figure 5.2. These study strategies are classified as case studies, interviews, experience reports, systematic literature review (SLR), survey, Literature Reviews and Delphi Study. These seven study strategies were initially identified by the primary reviewer during the data extraction process. However, secondary reviewer has validated these study strategies using the inter-rate reliability test.

Table 5.2 Total count of various study types

Study Type	**Count**
Case Studies	43
Systematic Literature Reviews	13
Literature Review	10

Survey	21
Interviews	16
Experience Reports	12
Delphi Study	3
Total	118

As shown in the table above, for the 118 studies undertaken, about 37% of the studies where case-studies there by giving us an idea of how project management issues have been dealt in the real-world. Roughly about 20% of the studies included are Surveys. This has provided us the luxury of gaining inputs from both industry as well as literature. GSD project management has widespread and inter-mixing domains hence about 23 literature reviews and Systematic Literature Reviews have also been included. About 16 interviews have been included to shed light on Industry based projects mostly in vendor destinations like India, China and Ireland (Dublin).

A further understanding about the various study types (measured linearly) using chi-square across the various success factors is provided in the table 5.3 below,

Table 5.3 Chi-squared Analysis for factors w.r.t study strategies

Factors	Study Strategies							Chi-square Test		
	Case Studies (n=43)	Interviews (n=16)	Experience Reports (n=12)	SLR (n=13)	Survey (n=21)	LR (n=10)	Delphi Study (n=3)	X^2	df	p
	Freq.	Freq.	Freq.	Freq.	Freq.	Freq.	Freq.′			
Organizational structure	27	7	6	9	16	6	2	0.822	1	0.365
Project managers′ skills	32	5	5	5	13	7	2	0.357	1	0.550
Communication	26	7	6	6	12	6	1	0.174	1	0.677
Requirement specification	18	7	4	5	8	5	1	0.009	1	0.924
Cultural awareness	20	7	5	5	6	3	1	2.204	1	0.138
Trust building	16	7	4	3	5	4	2	0.188	1	0.665
Collaboration	15	7	4	4	3	5	2	0.056	1	0.814
Work dynamics	13	7	3	4	5	3	3	0.140	1	.708
Shared Knowledge	13	6	3	2	7	1	2	0.145	1	.704
Team commitment and structure	10	5	2	6	3	3	2	0.342	1	.559
Time-zone difference awareness	6	4	3	5	4	3	2	3.048	1	.081
Cost assessment	7	5	2	2	5	0	2	0.058	1	0.809
Roles and responsibilities	4	2	2	0	6	2	1	2.510	1	.113
Shared goals	6	1	1	0	5	0	1	0.057	1	0.811
Customer awareness	3	1	2	0	5	0	0	0.333	1	0.564
Training	5	1	0	0	4	0	0	0.087	1	0.768
Time to delivery	2	2	1	1	3	0	0	0.064	1	0.801
Incremental cycles	3	2	1	0	1	0	0	1.646	1	0.199

From table 5.3, it can be observed that none of the 18 success factors enlisted, have a p-value <.05 implying an important point that none of the factors have a significant difference across the different type of studies included in the SLR. Simply put, all the success factors have been considered equally by all the studies included. For example consider the success factor, 'organizational structure'. Over 67% of all the study types, be it a case-study (27 out of 43 case-studies) or an interview (7 out of 16 interviews) or even a Delphi-study (2 out of 3) rate 'organizational structure' as a highly rated success factor for project management suggesting a similarity of opinion across all study types and hence earns a high value of chi-square and p-values respectively. Similar observation is made for factors like Project manager skills (0.357, .550) and customer awareness (0.333, .505) respectively. The high chi-square values suggest that such factors have a similar frequency of occurrence across all study types and also a very poor significant difference (across study types) because of high p-value.

On the other hand, observation can be made for many other factors which have a low/poor significant difference across various study types (i.e. high p-value) but a very low chi-square value suggesting incomparable frequency of occurrence across various study types(based upon the number of studies of a particular type). This means that in a particular type of study

(say Delphi Study) in which the total number of studies carried is low, the frequency of occurrence of a particular factor will be high.

This trend is predominantly visible in factors like 'Work Dynamics'. In this particular success factor, the number of Delphi-Studies carried is low (just 3) but the frequency of occurrence of this factor in the Delphi Studies is high (3 out of 3). However for this same factor, if other study types like Surveys or SLRs is considered, the frequency of occurrence of 'Work Dynamics' is very low for SLR (4 out of 13) and Survey (5 out of 21) respectively leading to a very low chi-squared value (0.140) but a high p-value (0.708). Similar trend can be observed for factors like 'Requirements Specification' (0.009, 0.924), 'Trust Building' (0.188, 0.665), 'Collaboration' (0.056, 0.814), 'Shared knowledge' (0.145, .704), 'Cost assessment' (0.058, 0.809) etc.

However irrespective of the variable frequency of occurrences (i.e. chi-square values) across all the factors, none of the factors has a p-value less than 0.05 suggesting, none of the factors has a huge significant difference of understanding across the various study types.

5.3.3 FACTOR CATEGORIZATION W.R.T COUNTRIES OR CONTINENTS

A country based categorization was made for the factors identified. In the following table, we show the countries where research was conducted for the papers included in our SLR study. Not surprisingly, the maximum number of studies (a total of 43) was carried out in the United States. This might be due to the fact that most of the multinational giants in the United States prefer GSD mode of development in collaboration with third world countries like India and China.

On the other hand many studies have also been carried out in eastern countries like India, China, and Pakistan as these countries are providing vendor services in GSD projects. Other geographic locations include Netherlands, Ireland and United Kingdom where the communication is carried out in English language and culturally these countries are more or less similar.

Table 5.4 Country based categorization

Country	Count	Country	Count
Australia	4	New Zealand	1
Brazil	5	Latvia	3

Canada	2	Malaysia	2
China	5	Netherlands	6
Singapore	1	Croatia	1
Finland	5	Pakistan	1
Germany	3	South Africa	1
Hawaii	4	Spain	2
India	10	Sweden	1
Iran	1	United Kingdom	5
Ireland	9	USA	43
Berlin	3		

Chi-square based analysis was performed on the success factors with the different entities being continents of Asia, Americas, Europe and Oceania. For better analysis, South Africa has been accounted along with Asia in our case. The chi-square based analysis for the factors is as shown in the table below,

Table 5.5 Chi-square analysis of factors w.r.t continents

Factors	Occurrence in SLR (n=118)	Chi-square Test

	Asia & South Africa (N=21)		Americas (N=54)		Europe & Oceania (N=43)		X^2	df	p
	Freq.	%	Freq.	%	Freq.	%			
Organizational structure	19	94	26	48	28	65	6.480	1	.011
Project managers' skills	17	80	26	48	26	60	0.559	1	0.455
Communication	15	71	25	46	24	55	0.573	1	0.449
Requirement specification	13	61	20	37	15	34	3.313	1	.069
Cultural awareness	15	71	17	31	15	34	5.304	1	.021
Trust building	14	66	17	31	10	23	9.9899	1	.002
Collaboration	14	66	17	31	9	21	11.465	1	.001
Work dynamics	12	57	14	26	12	28	3.806	1	.051
Shared Knowledge	10	47	14	26	10	23	3.243	1	.072
Team commitment and structure	12	57	11	21	8	19	8.174	1	.004
Time-zone difference awareness	12	57	9	16	6	14	11.421	1	.001
Cost assessment	9	42	10	18	4	9	9.100	1	.003
Roles and responsibilities	5	23	6	11	6	14	.235	1	.628
Shared goals	2	9	7	12	5	11	.024	1	.877
Customer awareness	1	4	5	9	5	11	.744	1	.388
Training	2	9	4	7	4	9	.108	1	.742
Time to delivery	1	4	4	7	4	9	.411	1	.522

Incremental cycles	3	9	3	4	1	2	1.626	1	.202

It can be observed from the table above that organizational structure finds a relevance to almost 94% of countries surveyed in the Asian continent. However in the Americas, it finds significance in only 48% of the countries while at least 65% of the European studies do mention the criticality of organizational structure as a significant factor to project management success. This is invariably proved from the fact that organizational structure has a high chi-square value but fairly less p-value (6.480, 0.011) indicating a significant difference in opinion across various continents. Success factor, 'communication' has a fair occurrence of 45%-55% across all the continents and hence provides for average chi-square and p-values of 0.57 and 0.449 respectively suggesting low difference in opinions across various continental geographies.

Another factor with a high degree of significant difference or low p-value is the 'cultural awareness' factor with frequency values of 71%, 31% and 34% across the continents of Asia, Americas , EU & Oceania. This is expected due to the fact that most of the vendors PMGs are situated in Asiatic locations while clients are across the West. The Asian companies need to understand the client requirements of the West, adept to their work styles and cultural preferences for obtaining projects and successfully

completing them. Hence factors like 'Cultural awareness' provide a fairly high chi-square value but very low p-value (5.304, .021). The same scenario can be observed for factors like 'team commitment and structure' (57%, 21%, and 19% frequency values), 'Time-zone differences' (57%, 16%, 14%), and 'Cost assessment' (42%, 18%, 9%) with all having high chi-square values but very low p-values of (8.174, .004), (11.421, .001) and (9.100, 0.003) respectively. A rationale to this can be a fact that teams on the Asian locations are considerate towards team structuring and role sharing compared to their Oceania and EU counterparts who are more concerned with the overall project completion instead of localized team organization and team structure.

Oceania projects are communication and requirement understanding based with stress on training and delivery schedules. It has been observed that many factors have significant difference of preference across various continental locations. Hence we reject our null hypothesis and propose that all the identified 18 factors have significant differences and a few similarities across various continents.

5.4 INDUSTRY DATA ANALYSIS

As discussed before in chapter 4, an online questionnaire was developed and passed onto respondents working across various GSD

domains, having variable experience in GSD projects and project management styles. The most convenient way of doing data analysis esp. on empirical and descriptive type of data is by the way of frequency estimation. Added advantage of frequency analysis is a case-to-case or side-by-side comparison of each factor identified from the SLR against its industry identified counterpart.

The factors where rated by the experts as to have a positive, negative impact on the project management success. Rational behind including negative impact was that according to some experts, a factor might a road-block in attaining/achieving other factors. A significant observation here is the fact that except for "Communication" known of the factors is devoid of negative influence on overall project management success. Not surprisingly, communication also stands out as the highest rated factor. This stems from the Experts' belief that if communication is comprehensive and transparent than it directly impacts the functioning of the project management team which is handling and guiding work on various offshore locations.

Most of the experts interviewed were part of project management teams working in tandem with other project management teams across various geographical locations worldwide hence the rate Project manager skills as a highly crucial factor to project management success in GSD.

Standing at a 97% positive impact rate, the skills necessary for a project manager have been identified to vary across a wide range of capabilities like knowledge of project, current market situation and scenarios, leadership quality, future scopes, employee problem understanding, project lacunas etc.

To mention is a fact that roughly 4% respondents who fail to credit project management as an essential factor are either junior level respondents or people with experience of less than 6 years. Experts across various experience levels have purported the roles assigned to them as a major factor for project management success. 97% of the respondents agree that the roles and responsibilities assigned to them are essential for smooth and efficient functioning of the team especially in-cases where the team is distributed across different geographical locations. This leads to increased trust and hope in the project management team and commitment from the entire team on the project goals and project managers' objectives. All this is made possible by using latest asynchronous and synchronous as well as coherent collaborative technologies. Hence most of these factors rate at over 95% of positivity on the success of the project management team.

Surprisingly work dynamics which includes the non-functional aspects of the project like coherence, coercion and cohesiveness have been rated as the least influential factor for project management success. 24% of

the respondents replied with a Not Sure response. This can be attributed to the fact that most of the respondents didn't have a clear idea of the degree to which these non-functional aspects have an influence on the project management team and the product itself.

Most factors have been rated on-par with the findings of the SLR and hence incremental cycle yet again finds a low mention and rates as only 46% of the respondents agree on it having a positive impact on the project management success. Very few experts disagree that customer awareness is essential to project management team's objective and goals while designing a project and control steps to achieve it.

Time-zone awareness is a concerning factor to higher level management but lower level management (17%) fail to consider it as a positive impact factor. Lower level employees consider shared knowledge as an important trust building and team goal side factor however the most experienced respondents don't entirely consider it crucial to project management success. Instead according to them, the project should have levels of transparency and levels of confidentiality. The following table summarizes the factors and the experts' view on their impact.

Table 5.6 Impact of expert opinion w.r.t success factors

Factors	Experts View(n=47)		
	Positive Impact	Negative Impact	Neutral

	Strongly Agree	Agree	%	Disagree	Strongly Disagree	%	Not Sure	%
Organizational structure	24	19	93	2	-	4	2	4
Project managers' skills	35	10	97	-	2	4	-	-
Communication	39	8	100	-	-	-	-	-
Requirement specification	29	16	97	1	-	2	1	2
Cultural awareness	34	10	96	3	-	6	-	-
Trust building	26	18	96	2	-	4	1	2
Collaboration	25	19	96	1	-	2	2	4
Work dynamics	18	7	54	1	-	2	11	24
Shared Knowledge	17	18	76	5	-	11	7	15
Team commitment and structure	25	19	96	1	1	4	1	2
Time-zone difference awareness	17	16	72	4	2	13	8	17
Cost assessment	10	26	78	2	-	4	9	20
Roles and responsibilities	28	17	97	1	-	2	2	4
Shared goals	13	15	61	8	-	17	11	24
Customer awareness	18	23	89	6	-	13	-	-
Training	24	21	97	1	1	4	-	-

Time to delivery	19	12	67	7	1	17	8	17
Incremental cycles	14	7	46	5	1	13	10	22

5.4.1 INDUSTRY ANALYSIS W.R.T SIZE OF ORGANIZATION

There are three main criteria used to define when a company is considered a small, medium or a large enterprise: the number of employees, the annual turnover and the assets of a company. Due to the scarcity of financial company data locally, most public and private bodies dealing with SMEs base their definitions merely on the first criterion, the number of employees.

Even then, however, there is no consistent definition of the thresholds which define whether a company is considered small, medium or large – neither between nor, often, within countries. The issue of definition is important, as only a generally agreed categorization of companies allows for collecting comparable data across sectors and countries.

Locally, different ministries employ a different approach towards categorizing the organizations. For example, the Saudi Arabian General Investment Authority has in the past classified small enterprises as having less than 60 employees and medium-size companies as having less than 100;

while The Small and Medium Enterprises Development Centre at the Eastern Province Chamber of Commerce and Industry defines small enterprises as those employing not more than 20 workers, while medium-size enterprises employ 21-100 workers.

Most of the companies referred to in the above estimations are man-power companies and specific to the oil and gas domain. There is little or no understanding of categorization of IT companies where the number of employees hired are far less compared to other business domains. Hence to remove any bias and avoid afore said discrepancies, a standard categorization scale based upon number of employees was used in the questionnaire. This categorization is a three-way classification as prescribed by Australian Bureau of Statistics[81]. The organizations are classified as SMALL (0-19 employees), MEDIUM (20 – 199 employees) and LARGE (200+ employees).

The results indicate that Small enterprises which are fairly less in number have either strongly agreed or simply agreed to all the factors identified from the survey. This has led to most of the factors having very low chi-square value and high p-value suggesting a low significant difference among the ratings provided by various organizations (based upon size) and hinting towards a fact that issues faced across various organizational sizes are more or less similar in nature while undertaking

GSD projects. Many success factors like 'Project Manager Skills', 'Trust Building', 'Work Dynamics', 'Shared Goals', 'Customer Awareness' etc. echo similar rationale with their chi-square and p-value pairs being 0.41 and 0.840, 0.018 and 0.894, 0.077 and 0.781, 0.002 and 0.969, and 0.002 and 0.962 respectively.

Another interesting observation amongst all the industry based responses is that irrespective of the chi-square value, none of the factors has a p-value of order <0.05 suggesting that there is no significant difference in opinion amongst the industry experts on all the success factors irrespective of their organization's size. There are however a few factors like 'Shared knowledge' and 'Training' where the chi-square values are relatively high (2.262, 1.769) and p-values relatively low (0.133, 0.184). A rationale behind the ratings of various factors by the respondents has been provided below.

Incremental cycle again remains the only factor that has been strongly disagreed upon by a small enterprise with rational being the fact that a small company will require a few more years to establish itself as a competitive source in the market and hence prefers long-phased, learning-based projects as a source to gain experience. On the other hand, only 1 large-scale enterprise disagrees to incremental cycle being a crucial factor while 65% consider it to be vital. A medium scale enterprise is in a transiency state and moving towards becoming a large scale enterprise. The

transiency is the capability of its project management team handling the offshore project teams and requires the experience of a trained and knowledgeable Project manager. Hence over 90% of the medium scale enterprises reflect upon a strong project manager as a vital key to project management success.

Not surprisingly, communication factor enjoys the highest rating or preference amongst all levels of enterprises and no company considers it as a negative characteristic. 80% of medium scale and 67% of large scale enterprises consider requirement specification as a critical factor to project success. This follows from the understanding of the project teams spread across various geographical locations who work towards the requirements specified in the Organization SRS policy/documentation. Cultural awareness at 76% (large scale enterprises), roles and responsibilities division at 71% (medium-scale) and Collaboration at 100% (small scale enterprises) find a mention at all company size levels with over 96% of experts purporting their importance in project management success.

Work dynamics seems to be the most intriguing/incomprehensible factor amongst all other factors as over a 55% of respondents across all the three levels fail to understand the characteristics covered by Work dynamics with regards to project management in GSD. Also the p-value is

high for work dynamics corroborating the fact that there is lesser similarity for it across various organizational sizes.

Shared goals enjoys lowest chi-square value while having a very high p-value which signifies that there is huge parity amongst organizations in terms of goal and objective sharing. This is due to fact that large organizations with project management teams managing vendor PMGs require clear access to current running objectives, accomplished milestones and future objectives of the offshore project management groups.

The following table summarizes the distribution of factors across various level of enterprises and their ratings of each factor.

Table 5.7 Chi-squared analysis for factors w.r.t team size

Factors	Company's Size															Chi-square Test (Linear by linear association)		
	Small (n=2)					Medium (n=10)					Large (n=34)					X^2	df	p
	SA	A	D	SD	NS	SA	A	D	SD	NS	SA	A	D	SD	NS			
Organizational structure		1	1	-	-	6	3	1	-	-	18	14	-	-	2	.239	1	.625
Project managers' skills	1	1	-	-	-	9	-	-	1	-	24	9	-	1	-	.041	1	.840
Communication	1	1	-	-	-	7	3	-	-	-	30	4	-	-	-	1.818	1	.178
Requirement specification	-	2	-	-	-	8	2	-	-	-	21	11	1	-	1	.137	1	.712
Cultural awareness	1	1	-	-	-	5	4	1	-	-	26	6	2	-	-	0.528	1	.467
Trust building	1	1	-	-	-	5	4	1	-	-	19	13	1	-	1	.018	1	.894

Collaboration	-	2	-	-	-	5	3	1	-	1	20	13	1	-	-	1.796	1	.180
Work dynamics	1	-	-	-	1	2	5	1	-	2	15	11		-	8	0.077	1	.781
Shared Knowledge	1	1	-	-	-	5	4		-	1	10	13	5	-	6	2.262	1	0.133
Team commitment and structure	-	2	-	-	-	5	4	1	-	-	20	12	-	1	1	.239	1	0.625
Time-zone difference awareness	1	1	-	-	-	3	4	1	1	1	10	11	3	1	9	.522	1	.470
Cost assessment	-	2	-	-	-	3	5	1	-	-	7	18	2	-	7	0.262	1	.609
Roles and responsibilities	1	1	-	-	-	7	3		-	-	20	13		-	1	.008	1	.929
Shared goals	1	-	-	-	1	3	3	1	-	3	8	12	7	-	7	0.002	1	.969
Customer awareness	-	2	-	-	-	4	5	1	-	-	13	16	5	-	-	.002	1	.962
Training	1	1	-	-	-	4	5	-	1	-	19	14	1	-	-	1.763	1	0.184
Time to delivery	-	1	-	-	1	5	3	1	1	-	13	8	6	-	7	.434	1	.510
Incremental Cycles	-	-	-	1	1	4	4	2	-	-	10	12	2	1	9	0.480	1	.489

5.4.2 INDUSTRY DATA ANALYSIS W.R.T GEOGRAPHIC LOCATIONS

In the questionnaire, a demographic field asking for the correspondents' country location was provided. The experts who responded were either native to these countries or have been working on GSD based projects in these countries or have prior work experience on GSD projects in these countries. The responses gathered reflects opinions from experts spread across the globe ranging from Oceania to Americas. As most of the experts were contacted via personal and online social media contacts, more than 52% contacts are located or based in India. This is

synonymous with the fact that most of experts are working on GSD based project companies in India (a hot hub for IT/ GSD outsourcing).

Also included in the questionnaire are responses from middle-eastern medium scale set-ups from the countries of Saudi Arabia and Jordan, signifying a nascent but promised interests towards global software development. About 15% of the responses (especially from higher level managers and project managers) have been coagulated from the Americas including United States and Canada. These respondents have either previously handled US-based GSD projects with offshore locations in India or are currently working on GSD based projects. The following table gives a country based count for each factor.

Table 5.8 Number of responses w.r.t country

Country	Count	Country	Count
Australia	**1**	Singapore	1
Bolivia	**1**	Switzerland	1
Canada	**1**	Jordan	**2**
Germany	**1**	New Zealand	**1**
India	**24**	Saudi Arabia	**6**
USA	**7**		

It can be observed from the following table 5.9 that, Americas give more importance to the cultural differences and work cultures of the offshore sites and hence agree completely upon cultural awareness as a crucial factor. On the other hand teams at many offshore locations like India and Singapore are more concerned with the type of work they are assigned and the responsibilities they undertake, hence rating roles and responsibilities at over 88%.

Another marked difference among opinion of respondents from various geographies is observed in the success factor 'Trust Building'. The Americas and the Europe rate it highly with an average of 82% frequency while in Asia it's rated as significant in only 40% of the organizations. This drop in over 40% of the responses leads it to have a significance difference in opinion across various geographies and hence a very low p-value of 0.044 and high chi-square value of 4.047. Similar pattern can be observed for the factor, 'Collaboration' with average frequency of 85% across Americas and Europe but a very high chi-square value of 3.61 and low p-value of 0.055 with only 36% of respondents being from Asia.

'Customer awareness' is a fact agreed upon by respondents across all geographies and hence fares a relatively high p-value (0.821) and significantly low Chi-square value (0.051). Similar trend is observed for 'team commitment and

structure' where teams in all the geographies are considerate towards their specific work roles and total team hierarchies.

Table 5.9 Chi-squared based analysis for industry data w.r.t continents

Factors	Occurrence in SLR (n=46)						Chi square Test(Linear by linear association)		
	Asia (N=33)		Americas (N=8)		Europe & Oceania (N=5)		X^2	df	p-value
	Strongly Agree	%	Strongly Agree	%	Strongly Agree	%			
Organizational structure	11	33	5	62.5	3	60	1.225	1	.263
Project managers' skills	16	48	6	75	4	80	0.489	1	.484
Communication	32	97	7	87.5	5	100	1.475	1	0.225
Requirement specification	28	85	5	62.5	4	80	0.875	1	.350
Cultural awareness	30	91	8	100	3	60	.668	1	.414
Trust building	14	42	7	87.5	4	80	4.047	1	0.044
Collaboration	12	36	7	87.5	4	80	3.678	1	.055
Work dynamics	10	30	4	50	4	80	1.638	1	0.201
Shared Knowledge	7	21	4	50	-	-	0.114	1	0.735
Team commitment and structure	16	48	6	75	3	60	.022	1	0.882
Time-zone difference awareness	7	21	5	62.5	3	60	1.552	1	0.213
Cost assessment	3	9	3	37.5	-	-	1.394	1	0.238
Roles and responsibilities	29	88	5	62.5	3	60	.177	1	0.674
Shared goals	4	12	3	37.5	1	20	0.403	1	0.526
Customer awareness	6	18	5	62.5	2	40	0.051	1	0.821
Training	18	54	5	62.5	1	20	1.145	1	0.285
Time to delivery	13	39	4	50	1	20	0.335	1	0.563
Incremental cycles	7	21	3	37.5	1	20	0.762	1	0.383

5.5 COMPARISON OF SLR FINDINGS AND INDUSTRY BASED DATA SET

The factors identified earlier via the SLR are marked against the factors identified via real-world practice/expert opinion. During the SLR, frequency was estimated for every factor. Similar frequencies based upon 5-grade system (strongly agreed, agreed, disagree, strongly disagree, neutral) were estimated for factors identified through expert opinions. Since the frequencies estimated via SLR were cumulative and the frequencies estimated via the 5-grade system were subjective, a common measure was needed to scale these frequencies w.r.t to one another to identify the similarities, differences and relative dependencies between the two data sets.

A mathematical approach to identifying the similarities and differences between the two data sets seems the logical solution. Amongst the various techniques available, Pearson correlation coefficient technique provides a clear and concise approach. It gives the linear dependence between two entities with 1 being a total linear dependency and its values ranging from -1 to +1.

In our study, we calculate the Pearson correlation coefficient using the Spearman's Rank order correlation technique. Ranks are estimated for all

frequencies obtained via SLR. This rank element gives the x-variable for Pearson correlation. Similarly ranks are estimated for the 'Strongly Agreed' upon frequencies obtained via experts' opinion. This becomes the y-variable for the Pearson correlation. After determining the correlation coefficient, a scatter plot is drawn to determine the similar or interdependence graphically. The following table provides the values for the frequencies for each factor w.r.t to the SLR and the real-world study.

Table 5.10 Ranked frequencies for SLR and Industry Data

Factors	Occurrences in SLR (n= 118)		Factors, strongly agreed upon by experts (n= 46)		Average Rank
	%	Rank	%	Rank	
Organizational structure	73	18	24	9.5	13.75
Project managers' skills	69	17	35	17.0	17.00
Communication	64	16	39	18.0	17.00
Requirement specification	48	15	29	15.0	15.00
Cultural awareness	47	14	34	16.0	15.00
Trust building	41	13	26	13.0	13.00
Collaboration	40	12	25	11.5	11.75
Work dynamics	38	11	18	6.5	8.75
Shared Knowledge	34	10	17	4.5	7.25
Team commitment and structure	31	9	25	11.5	10.25
Time-zone difference awareness	27	8	17	4.5	6.25
Cost assessment	23	7	10	1.0	4.00
Roles and responsibilities	17	6	28	14.0	10.00
Shared goals	14	5	13	2.0	3.50
Customer awareness	11	4	18	6.5	5.25

Training	10	3	24	9.5	6.25
Time to delivery	9	2	19	8.0	5.00
Incremental cycles	7	1	14	3.0	2.00

In order to quantify the significance of the similarity in the motivation factors identified using the SLR and empirical study, we performed a correlation analysis test. Table 5.11 presents Spearman's Rank order correlation. The analysis shows that there is a moderate correlation between the results obtained from SLR and empirical study (through the questionnaire). Spearman's correlation Coefficient is 0.6 whereas p=0.208.

Table 5.11 Spearman co-relation for SLR and Survey Data

			SLR	Survey
Spearman's rho	SLR	Correlation Coefficient	1.000	.641
		Sig. (2-tailed)	.	.004
		N	18	18
	Expert opinions	Correlation Coefficient	.641	1.000
		Sig. (2-tailed)	.004	.

The correlation results are identified as having spearman correlation coefficient values, r = 0.641 and the P-value = 0.004. This results suggest that the two data sets or the factors identified via the SLR and the questionnaire have a moderate or above average dependency on one another however they have a great deal of statistical significance on one another.

A scatter plot gives the linear dependency between the data sets of frequencies from the SLR and the opinions respectively. In our result, the scatter plot suggests that there is some (64.1%) degree of dependency. Hence the two ranked frequencies are moderately dependant as shown in figure 5.3 below,

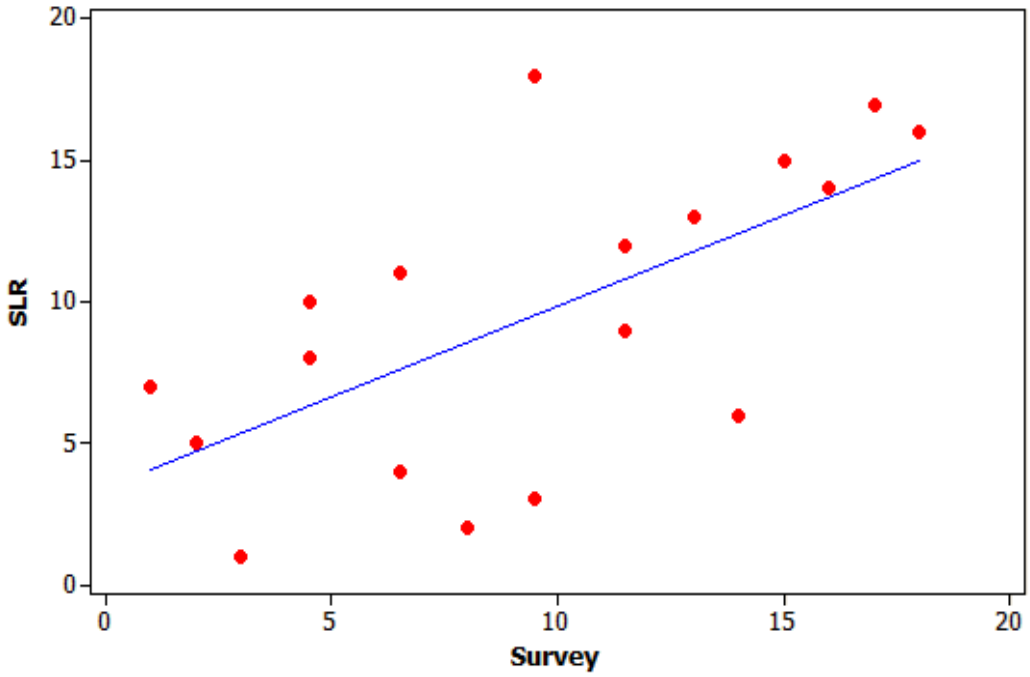


Figure 5.3 Scatter plot for SLR vs Survey

5.6 THOUGHTS & INFERENCES BASED ON ANALYSIS

The research questions were designed to address issues faced by project management groups in local SMEs adopting GSD. Managers of local software development organizations will be able to use the GLOBFACT in order to assess the factors that are specific to their requirements based upon their development methods, strategies and processes. This will

provide local software practitioners with ability to understand the strengths and weaknesses of current project management processes and to address areas that need attention by implementing the recommended set of best practices. Improvement can then be implemented on a rational and targeted basis. Ultimately this work will put local organizations in a better position to deliver what customers want.

In order to answer the objective questions enlisted in phase-1, an exhaustive list of success factors were identified from literature via SLR. All the factors were weighted against their frequency of occurrence in the studies and a threshold frequency (>45%) was estimated. The threshold frequency gives the least amount of occurrence of a factor in all the studies cumulated. As a result, Organizational structure, project manager skills, communication, requirement specification have been identified to be the most motivating factors for project management success in GSD. In addition, factors like cultural awareness and trust building are considered significant. The table overleaf summarizes the factors for each study above the ordinal thresholds.

Table 5.12 Study strategies marked against factors and their frequency thresholds

Study Strategy	No. of Success Factors	No of factors above frequency threshold
Case Study (n=43)	18	4 factors: • Organisational Structure • Project manager skills • Communication

		• Requirement Specification
Interviews (n=16)	16	4 factors: • Organisational Structure • Project manager skills • Communication • Requirement Specification
Experience Reports (n=12)	17	4 factors: • Organisational Structure • Project manager skills • Communication • Requirement Specification
SLR (n=13)	18	4 factors: • Organisational Structure • Project manager skills • Communication • Requirement Specification
Survey (n=21)	16	4 factors: • Organisational Structure • Project manager skills • Communication • Requirement Specification
LR (n=10)	15	4 factors: • Organisational Structure • Project manager skills • Communication • Requirement Specification
Delphi Study (n=3)	10	3 factors: • Project manager skills • Communication • Requirement Specification

In the experts' opinion, communication and requirement specification find a mention at all three levels of organizations. However the most significant factor is 'Agreed' upon by the experts at small scale enterprise level. This can be attributed to the fact that SME employ roughly less than 20 employees and are more focussed towards product visualisation rather than the process and project visualization. On the other hand, Incremental cycles is the least significant factor across all levels of organization.

Once the most and least significant factors were identified from the literature and the industrial study, a rank based correlation was estimated using Pearson's correlation on ranked frequencies (spearman ranking) of these factors. The following conclusions were identified:

- The correlation results are identified as having spearman correlation coefficient values, r = 0.641 and the P-value = 0.004.
- This results suggest that the two data sets or the factors identified via the SLR and the questionnaire have a moderate or above average dependency on one another however they have a great deal of statistical significance on one another.

It can be observed that Delphi Study has only three factors Project manager skills, communication and requirement specification as the only factors above the threshold frequency value which find a mention in them. Hence communication and project manager skills are considered as the

most vital factors to success of project management. Organisational skill only fails to find a mention in the Delphi studies, however it is the highest rated factor at a frequency of above 73% and hence is the another vital factor to project management success. Also to mention is a fact that Incremental cycle is the lowest frequency factor occurring in only three types of cases studies.

Another significant point to be addressed is the fact that none of the factors identified via SLR has been deprecated or annulled by the real-world industry experts. Also the experts have failed to mention any new factor in the survey.

In the next chapter, we propose a framework named GLOBFACT and then perform a case-study assess our framework performance.

CHAPTER 6

GLOBFACT: FRAMEWORK & CASE-STUDY

In this chapter we summarize our findings and present them as a model based framework named as GLOBFACT. The identified factors and best practices from the previous chapters are coagulated into a knowledge-areas based framework and proposed as GLOBFACT FRAMEWORK FOR PROJECT MANAGEMENT SUCCESS IN GSD PROJECTS.

6.1 PROPOSED FRAMEWORK

A GLOBFACT framework was developed using the factors and best practices from previous chapters as building blocks. All similar type of factors were augmented into the ten knowledge areas and presented as shown in the following table 6.1. The knowledge areas used for coagulation of our factors are integration, scope, time, cost, quality, human resources, communication, risk, procurement, and stakeholder management as suggested in the PMBOK (Project Management Book of Knowledge). The figure overleaf provides the various facets of GLOBFACT clustered together into a single framework.

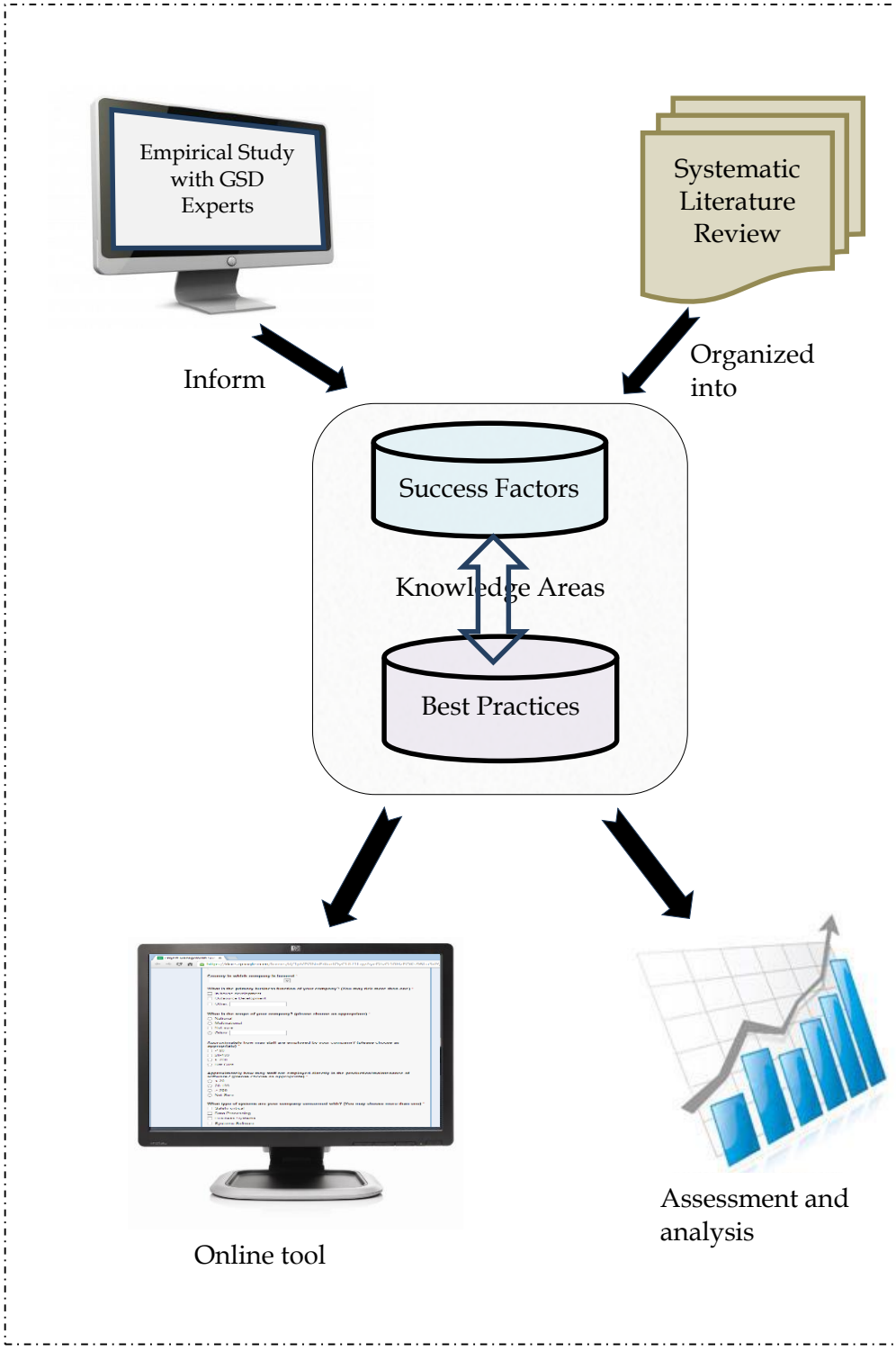


Figure 6.4 GLOBFACT framework model

The knowledge areas unit shown in the figure above, is formed by integrating the success factors as shown in the following table.

Table 6.13 Knowledge Areas & Related Factors

Knowledge Area	Success Factors
1. Integration	• Co-ordination
2. Scope	• Requirement engineering activities.
3. Time	• Time to delivery • Allocation of tasks
4. Cost	• Cost assessment
5. Quality	• Work dynamics • Incremental cycles
6. Human Resources	• Cultural awareness • Trust building • Training • Project managers' skills • Roles and responsibilities
7. Communication	• Cultural awareness • Communication awareness (linguistic approach) • Time-zone difference awareness • Collaboration • Organizational structure • Shared Knowledge • Team commitment and structure
8. Risk	• Communication (risk based approach) • Collaboration (risk based approach)
9. Procurement	• Trust building (vendor side).
10. Stakeholder	• Customer awareness • Shared goals

We had earlier identified set of best practices for each factor via the literature and the industry-based survey. We implement these best-practices as waypoints for a project management teams opting for GSD to cover all the project management knowledge areas. It can be observed in the above table that a few factors are repeated or broken into variable parts.

This has been done to implement best practices for a factor specific to a particular knowledge area. As an example, if a project management team is trying to cover the 'Scope' knowledge area under GLOBFACT, it implements the best practices specific to requirement engineering activities as shown in the figure below:

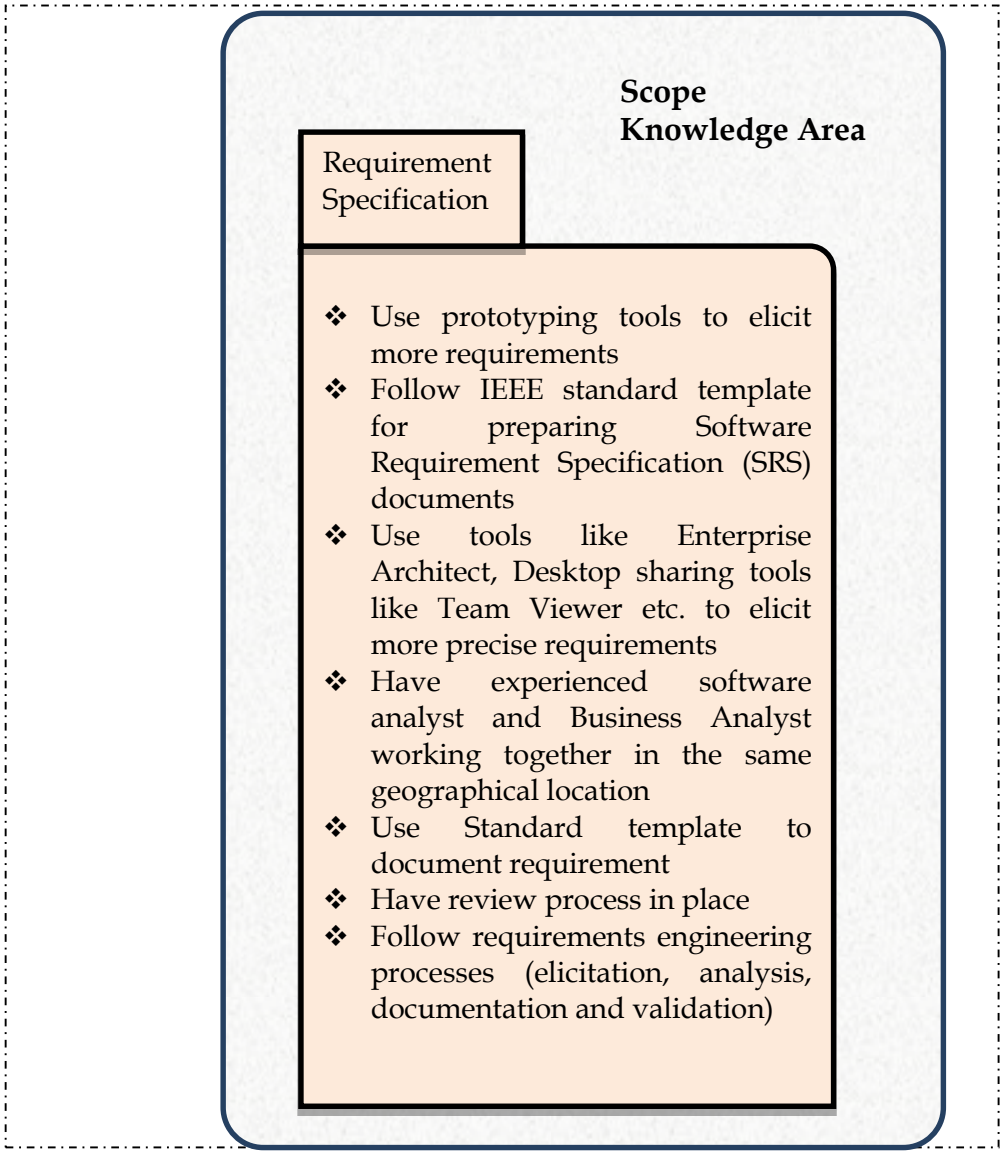


Figure 6.5 Requirement specification best practices under Scope KA

6.2 FRAMEWORK ASSESSMENT

Once the knowledge areas have been formed with the specified success factors and best practices, a metrics is needed for a project management team to gauge its degree of readiness or adaptability to a particular recommended practice. For a comprehensive evaluation, this assessment has to be a three-fold assessment. The three folds being,

- If the practice is not been implemented yet, create procedures to implement it.
- If the practice is available but not implemented completely then create procedures to develop it further.
- Finally, once the practice has been fully established, validate the outcomes because of the implementation of the practice.

To address these three-fold objectives, there has to be a baseline to address project management team's current stature, next milestones to be covered and future objectives. A simple mathematical value (ordinal in nature) can be a good waypoint for a company to gauge its current level. But because of the subjective nature of our model, a more coherent and robust mathematical model needs to be implemented. The best and most simplistic way of accomplishing this objective is by the use of Motorola Assessment Model attributed to the likes of Daskalantonakis[82].

6.3 MOTOROLA ASSESSMENT MODEL

In this model, the three desired objectives (enlisted in the previous page) along which a project management team analyzes its' readiness towards a practice are integrated into three dimensions which are graded against all the best practices described. These three dimensions are:

- Approach: It determines the willingness or preparedness of an organization to implement a given practice.
- Deployment: It determines the consistency and continuity of the usage or follow-up of a practice in the organization.
- Results: As the name suggests, timed results are determined by this dimension upon implementation of a practice.

All the best practices are graded along these three dimensions and a cumulative score for each factor is determined as follows:

- Every practice is graded across the three dimensions on a score range ranging from a grade 'poor' to an 'outstanding' grade. These grades are assigned ordinal values with values ranging from 0-10 for poor to outstanding respectively (please refer to table 6.3 for complete grading criteria for Motorola instrument).

- The average value for each practice is calculated then a final average of all the practices is evaluated from the previous averages.

- This overall average score is then evaluated against the average score criteria presented by Daskalantonakis[82]. If the overall average score is greater than value 7 then that particular factor is said to be well under practice by the project management team. A value less than 7 is considered to be a weakness and the project management team needs to address that particular success factor.

The following table gives an example representation of the factor requirements specification and its related best practices being valued using the Motorola metrics system.

Table 6.14 Motorola instrument based values for Requirements Specification factor

Practice	**Approach** (score range: 0,2,4,6,8,10)	**Deployment** (score range: 0,2,4,6,8,10)	**Results** (score range: 0,2,4,6,8,10)	**Average Score of the three dimensions values)**
1. Use prototyping tools to elicit more requirements	6	6	6	6
2. Follow IEEE standard template for preparing Software Requirement Specification (SRS) documents	6	6	4	5.333333
3. Use tools like Enterprise Architect, Desktop sharing tools like Team Viewer etc. to elicit more precise requirements	6	6	4	5.333333
4. Have experienced software analyst and Business Analyst working together in the same geographical location	10	10	8	9.333333
5. Use Standard template to document requirement	10	6	6	7.333333

6. Have review process in place	6	8	6	6.666667
7. Follow requirements engineering processes (elicitation, analysis, documentation and validation)	8	6	6	6.666667
Overall Score : (Dividing 'Sum of average scores' by 'total no. of practices') =				6.66

Here, the overall score for the requirements specification factor has been determined to be of value 6.66. This value suggests that requirement specification has values 7.4, 6.8, 5.71 across dimensions of approach, deployment and results respectively. Hence to have significant result improvement (attaining a score of 7 or more), the factor should reach a score of 8 and 7 across the dimensions of approach and deployment.

Once metrics are determined for all factors within a knowledge area and then across all knowledge areas, the project team obtains a fair idea of which factors to improvise upon. Thus, at the end of the assessment, the project management teams have a clear idea of where exactly they stand and what stones they need to uncover in propelling themselves towards GSD based projects.

6.4 CASE-STUDY

To validate our claims made above, we carried out a case-study with a local company which is a subsidiary of an oil-and-gas based multinational giant and provides various IT related resources and services. This company

(which we have termed as MJC to preserve its privacy) carries out various GSD development projects with contractors and vendors spread across countries in Asia and MENA region. The personnel who has co-acted on the company's behalf and helped us with our survey is a project manager in the company and has a rich GSD experience of over 14 years. His replies in the survey are a representation of his thoughts and knowledge of the procedures, techniques, policies of his company and don't necessarily express the state of his company's current organizational and fiscal standing.

Nevertheless the data he provided has been accounted and a case-study is presented to validate our findings. All the metrics are based upon the Motorola instrument which have discussed in the earlier section.

To provide easy accessibility, the questionnaire was created as an online survey using Google Docs. The manager had grade every practice under a factor across all the three dimensions of approach, deployment and results and only then could he move to answering next knowledge area (it should be noted that, this restriction was only made due to limitation of Google docs, while in GLOBFACT a project management team can work on improvising several knowledge areas in parallel).

The questionnaire provided the manager with the ability to gauge the policies and procedures in his company based upon the recommended

practices and analyze as to where exactly the project management team stands in the threefold objective scenario expressed in Section 6.2. The results for the survey were accumulated over a period of 3 months from August 2013 to November 2013.

Amongst the 18 factors across which the project management team was graded, we provide rationale for a few factors to preserve understandability. We present the metrics for a factor in which the company adeptly showcases its' readiness for GSD (average score >7) and then we present a case where the company needs to implement recommended practices for readiness (average score <7).

6.4.1 READINESS RELATED FACTOR

The project manager is a very experienced personnel and has been handling the projects for a long time. Employing this rich experience, the project manager under the aegis of his senior project management team has developed a robust organizational structure where right from training to contingencies planning, excellent care has been taken by the project management team.

This is reflected from the high assessment scores of the team for the factor Organizational structure as shown in the following table. Moreover, the average scores of 8, 9 and 8.5across the dimensions of approach,

deployment and results suggest that the project management is ready as far as the organizational structure factor is concerned.

Table 6.15 Motorola assessment score for organizational structure

Practice	**Approach** (score range: 0,2,4,6,8,10)	**Deployment** (score range: 0,2,4,6,8,10)	**Results** (score range: 0,2,4,6,8,10)	**Average Score of the three dimensions values)**
1. Promote horizontal as well as vertical mobility across organization domain.	8	8	8	8
2. Establish a transparent organization hierarchy with regards to creativity and seniority.	10	10	10	10
3. Have training based on client's culture.	6	8	6	7
4. Have experienced people at higher levels.	10	10	10	10
5. Have a protocol for backup and emergencies.	8	6	6	7
6. Organize icebreakers and forge understanding between members	10	10	10	10
7. Assign certified and skilled employees at every level for better process output.	10	10	10	10
Overall Score : (Dividing 'Sum of average scores' by 'total no. of practices') =				9

6.4.2 WEAKINESS RELATED FACTOR

Now we include the factor, from a knowledge area where-in the assessment score of the company is fairly poor and requires improvement over many practices to embark on readiness.

The company MJC has always maintained high level training documents. One reason for this is the fact that the company has always followed a hiring process where-in most of the employees recruited have large experience or fairly high experience. This has resulted in a low-scale hiring of newbies or fresh recruits. As a result very low focus has been given on maintaining detailed or newbie oriented training documents. Instead training is via a buddy system on live-project itself.

This system has another disadvantage that instead of maintaining a proper training channel, the company has practiced maintaining a common data repository for across the domains access. For a newly hired personnel this becomes an overhead for mining trivial data from the voluminous amounts of data available.

Because less resources have been allocated to training procedures and policies, little consideration is made towards arranging internal audits, meetings, training sessions and external training sessions where employees can go out to training institutes to get certified and trained on new tools and

technologies. The following table provides the Motorola metrics for the shared knowledge factor which summarizes the findings.

Table 6.16 Motorola metrics for shared knowledge

Practice	**Approach** (score range: 0,2,4,6,8,10)	**Deployment** (score range: 0,2,4,6,8,10)	**Results** (score range: 0,2,4,6,8,10)	**Average Score of the three dimensions values)**
1. Have a centralized documents/knowledge sharing point.	8	8	8	8
2. Have knowledge transfer sessions for new staff.	8	8	8	8
3. Send the required resource to training centers to acquire specialized skills.	2	2	2	2
4. Have a standard Application Knowledge Document (technical) at a very low level so that it can be used for any new comer to learn the system across the globe.	0	0	0	0
5. Use organizations knowledge resources to acquire necessary skills.	6	8	6	7
6. Arrange technical training during employee orientation program.	8	6	8	7
7. Attend internal and external trainings	4	2	4	3
8. Coordinate the work among different people using standards documentation.	0	0	0	0
Overall Score : (Dividing 'Sum of average scores' by 'total no. of practices') =				4

The average score across the dimensions of approach, deployment and results is roughly 5, 5, and 5 giving a low total average of just 4. This suggests that the project management team needs to rework its policies on training and documentation. The team needs to provide resources for internal and external training sessions, and needs to implement a standard Application Knowledge Document which can be accessed by all newbies to learn and explore.

Using similar principle, the project management team was able to ascertain which knowledge areas require a re-work and improvement and across which factors with-in these knowledge areas, consistency needs to be maintained enabling a readiness towards GSD projects. Once the project management team had metrics for all knowledge areas and had evaluation of results (after 3 months), the project manager was provided a self-evaluation feedback form to rate our GLOBFACT framework. The evaluation is made via an online Google doc form.

The results of the feedback evaluation suggest that the project manager believes that GLOBFACT is an effective tool for a project management team in gauging its readiness for GSD projects. This is hardened from the fact that the project manager has graded our tool to be easily understandable and effective. The project manager has 'Strongly Agreed' upon the satisfaction level of its use for all companies opting for

GSD. He also 'Strongly Agreed' upon the fact that our framework could easily alienate strong and weak readiness factors from each other with considerable ease. A complete list of the views of the project manager based upon our readiness model are expressed in the table 6.5 below:

Table 6.17 Feedback for GLOBFACT effectiveness

Views	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*	*No Comments*
Clarity	✓				
Consistency		✓			
Prior knowledge	✓				
Understandability		✓			
Generality		✓			
Categorization		✓			
Usability			✓		
Proposed improvement		✓			
Regularity of use			✓		
Transparency	✓				
Effectiveness of practices suggested		✓			
Current state evaluation		✓			
Agreement on results	✓				
Overall thoughts are positive		✓			

From the table 6.5, it can be seen that the project manager is satisfied or has agreed to the effectiveness of our framework as a guide or roadmap to the project management teams opting for GSD. Another table providing a complete list of the assessment scores faired against various success factors by the company MJC is highlighted below:

Table 6.18 Assessment scores of various factors for company MJC

Knowledge Area	Challenge/Success Factors	Approach	Deployment	Result	Average Assessment Score
Scope	*Requirements Specification*	7.428571	6.571429	6.285714	6.761905
Time	*Time to delivery*	8.285714	6.571429	8.571429	7.809524
	Allocation of tasks	8.571429	7.142857	7.714286	7.809524
Cost	*Cost assessment*	7.66	7.66	7	7.44
Quality	*Work Dynamics*	5.33	4.66	5.33	5.106667
	Incremental cycles	4.4	4	3.6	4
Human Resources	*Cultural awareness*	7.636364	6.727273	6.545455	6.969697
	Trust building	6	5.230769	4.923077	5.384615
	Training	5.25	4.5	4.5	4.75
	Project managers' skills	7.333333	6.444444	6.666667	6.814815
	Roles and responsibilities	5.714286	4.857143	4.285714	4.952381
Communication	*Time-zone difference awareness*	6.75	6.25	6	6.333333
	Collaboration	7.5	7	6.25	6.916667
	Geographical distance	7.25	6.75	5.25	6.416667
	Organizational structure	8.857143	8.857143	8.571429	8.761905
	Shared Knowledge	4.5	4.25	4.5	4.416667
	Team commitment and structure	8.4	8.4	8	8.266667
Risk	*Rsk management activities*	6.66	5.33	4.66	5.55
Procurement	*Managing contract relationship with vendor*	6.666667	6	5	5.888889
Stakeholder	*Customer awareness*	7.666667	7	7	7.222222
	Shared goals	7.333333	6.333333	6.666667	6.777778
Integration	*Communication activities*	8	6.666667	6.666667	7.111111

The light green assessment values signify a comfort state for a particular success factor, meaning that the company is well-formed in employing the success factor and reaping effective results. The dark green values signify an effort towards garnering results by the company and the best practices specific to a particular KA are in the deployment state. Finally the grey areas specify the regions where the company MJC has to make an effort towards employing techniques for deployment and in turn reaping results from the enlisted best practices.

Based upon this validation, we safely conclude that if a company wishes to opt for GSD based projects then its project management team should try to implement the various factors we have enlisted across the different project management knowledge areas to successfully opt or approach for GSD projects. Hence GLOBFACT can be touted as a readiness tool for project management success in GSD and the success factors identified are rightly considerate in assessing the readiness.

6.5 THREATS TO VALIDITY

This study applied a combined SLR and empirical study approach. The SLR was focussed on determining the success factors pertaining to project management success in GSD. The type of business handled by most

of the companies sighted, studied and referred in the literature are specific to global software development domain. Hence all the factors related to project management across other domains like oil and gas, banking, marine engineering etc. have left out of the study. Also the study is focussed on developing framework for nascent Saudi companies going towards global software development and hence this framework is not a substitute or in-lieu of other staged frameworks like SPI, CMMI etc.

The real-world study does not only include expert opinions from public working or having an experience of working in the Middle East esp. in Saudi Arabia but also includes opinions from experts from different regions like India, USA, Australia, Canada etc. However care has been taken that only to include only those reviews/ opinions; whose respondents have either worked earlier in GSD environment or are currently based in such environments.

The expert opinions garnered contain people of varied skill and experience levels to have diversified opinions about each factor and experience range scales from 2 to 20 years (both inclusive). Even though the questionnaire was made available online on social networking sites like LinkedIn and Facebook, it failed to generate a hypothetically anticipated target of 80+ respondents. However the responses obtained are on par to generate and analyse the results and come with robust or significant

conclusions. The study would have been richly benefited from a previous case study on global software development in the MENA region but unfortunately the authors couldn't come across any such case studies carried in the past 5 years.

Irrespective of the above limitations, the study and conclusions are coherent and robust enough to provide insights into the intricacies involved in approaching GSD for local companies and provides a formidable framework for the companies to assess and ready themselves for the lurking challenges of project management in GSD.

CHAPTER 7

CONCLUSION AND FUTUREWORKS

In this chapter we summarize our findings provide a brief conclusion of our journey in realization of our framework. Also provided is a future path where this study can be molded for further research and investigation and benefit for all.

7.1 CONCLUSION

The GSD is a modern software engineering paradigm. Many companies are adopting GSD to reduce software development cost and improve quality. Vendor organizations are struggling to compete internationally in attracting software development projects. Due to the increasing trend of GSD we are interested in discovering project management challenges in GSD projects. In this paper, we identified a list of success factors for project management in GSD. Among the 18 identified factors, we found that organizational structure, project manager's skills and communication and are the most common success factors.

From the questionnaire based survey set of way maps or best practices have been identified which can provide the project management groups with means of attaining readiness levels for global software development.

Based upon all the findings from the SLR and the industry related survey, we presented our framework integrating it into the various knowledge areas. Once the integration was done, we performed a case-study to assess and validate the comprehensiveness of our tool. Once our findings were validated, we present the framework which can be used for researchers, industrialist and business enthusiasts how are interested in the myriad world of Global Software Development.

A tangible future accomplishment of this readiness model is an online web tool which will integrate our model GLOBFACT with a challenge based model, a social-computing tools oriented model and present these models as a parent or umbrella model named GLOB which will be a comprehensive and complete readiness tool for assessing readiness and will be accessible by one and all can be used for the greater good.

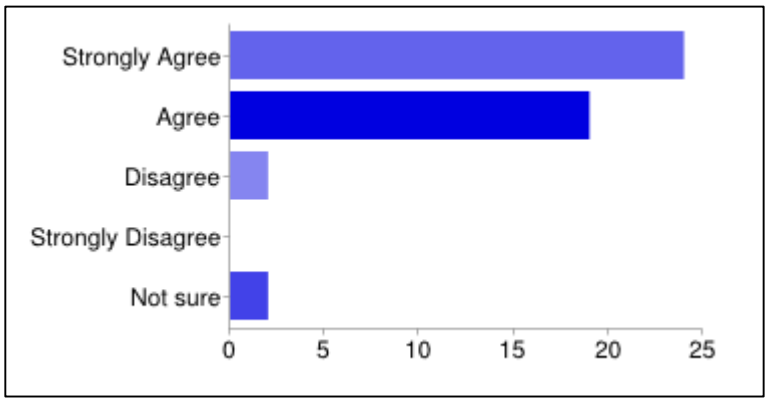
APPENDIX

List of 18 identified success factors with their respective best practices and mapped knowledge areas.

Factor 1. Organization Structure

Knowledge Area: Scope

Strongly Agree	**24**	51%
Agree	**19**	40%
Disagree	**2**	4%
Strongly Disagree	**0**	0%
Not sure	**2**	4%



Best Practices:

1. Promote horizontal as well as vertical mobility across organization domain.

2. Organization hierarchy should be transparent with regards to creativity and seniority.

3. Should be robust and free of economic breakdown.

4. Have training based on client's culture.

5. Structured should be documented and in place to follow.

6. Efficiency is a direct measure of how organization is structured vertically and horizontally at various levels.

7. Experienced people at higher levels.

8. Always have a protocol for backup and emergencies.

9. Organize icebreakers and forge understanding between members

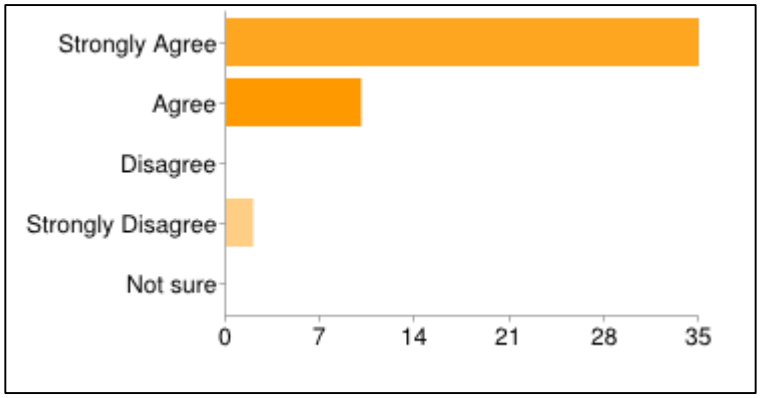
10. Certified and skilled employees at every level for better process output.

11. Robust and not volatile to market economic situation.

Factor 2: Project Manager Skills

Knowledge Area: Human Resource Management

Strongly Agree	**35**	74%
Agree	**10**	21%
Disagree	**0**	0%
Strongly Disagree	**2**	4%
Not sure	**0**	0%



Best Practices:

1. Project manager skills should include experience and prior domain expertise.

2. Should be relatable to problems of lower level employees.

3. Should have a hands-on international experience of the project running.

4. Should be aware of latest trends in software development and future scopes.

5. Should set up priorities- develop and enhance plan and vision.

6. Should be PMP certified.

7. Leadership skills, organisational skills, meeting deadlines and leading a team rather bossing around the other employees.

8. Project manager has to be a certified, fun-loving and a dynamic professional with capability of leading and providing a direction to the team.

9. Should accept challenges and related criticism.

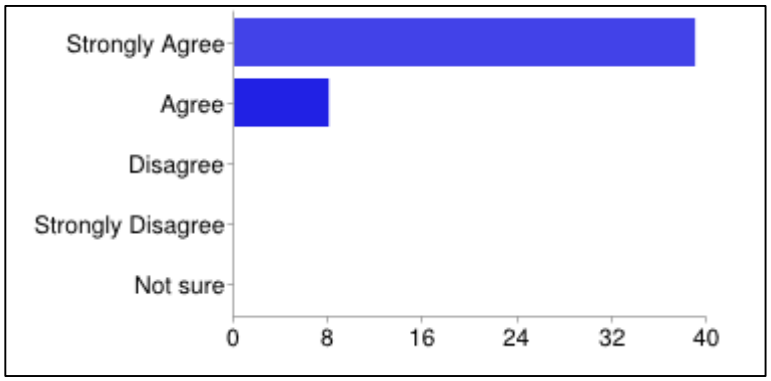
10. Leadership and good experience "Reference" is a must. - Monitoring and control capabilities also a must.

11. Effective project management requires that the project manager understands and uses the knowledge and skills from at least four areas of expertise. PMBOK (Project Management Body of Knowledge) Application Area Knowledge: standards and regulations set forth by ISO for project management, General Management Skills and Project Environment Management.

Factor 3: Communication

Knowledge Area: Communication

Strongly Agree	**39**	83%
Agree	**8**	17%
Disagree	**0**	0%
Strongly Disagree	**0**	0%
Not sure	**0**	0%



Best Practices:

1. Email is the best and most efficient means of communication.

2. Bi-weekly meetings/conferences via video-conferencing.

3. Creation of a common template status report shared and commented across by various level hierarchy

4. Project objectives before-hand via team meetings.

5. Availability of state-of-art instant communication systems online always.

6. Needs to update technology to be robust and provide multiple features like file sharing, logging, remote access, sharing over cloud etc.

7. Frequent heads-up or status check meets.

8. Implementation technology which helps towards project progress.

9. Communication systems should provide privacy and restrictions at different levels for security and should at the same time provide and ordering and logging.

10. Single POC systems usually eradicate many issues.

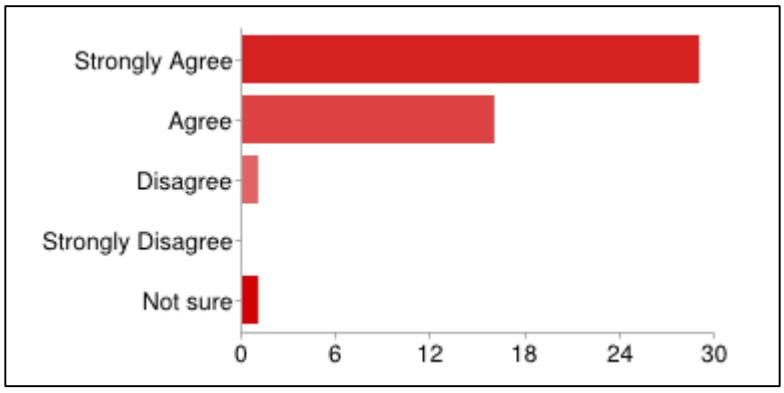
11. Use virtual meeting boards and central repositories.

12. Greatest challenge is to support access in sporadic access or very limited access remote locations like deserts and mountains (like airplane navigation systems).

Factor 4: Requirement Specification

Knowledge Area: Scope

Strongly Agree	**29**	62%
Agree	**16**	34%
Disagree	**1**	2%
Strongly Disagree	**0**	0%
Not sure	**1**	2%



Best Practices:

1. External GUI requirements, functional requirements, performance, requirements and design constraints should be stated clearly.

2. Compliance with standard coding procedures and logical database design protocols.

3. Software system attributes like reliability, availability, security, maintainability and portability.

4. Start with existing requirement framework and build upon radically.

5. SRS and documentation should be clear, comprehensive and transcendental.

6. Requirements are generated as a course of other parameters or environs hence frequent requirement consideration should be encouraged before coding starts.

7. Design and conduct workshops all the time.

8. Agile practices like SCRUM are the best techniques.

9. Output targets should be tangible and possible within available resources.

10. Seamless transfer to new platforms and over cloud is a necessary requirement in today's environment and should be considered.

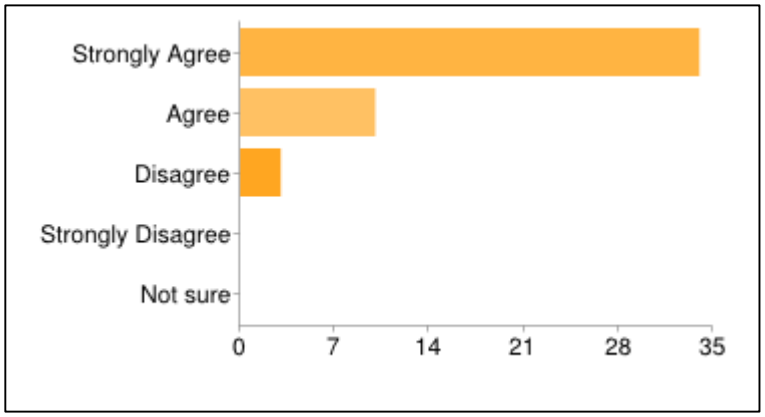
11. Use tools like Enterprise Architect, Desktop sharing tools like Team Viewer etc. to elicit more precise requirements.

12. Prototypes are known to be a great guide towards understanding requirements but are time consuming and resources hungry by nature.

Factor 5: Cultural awareness

Knowledge Area: Human Resource Management

Strongly Agree	**34**	72%
Agree	**10**	21%
Disagree	**3**	6%
Strongly Disagree	**0**	0%
Not sure	**0**	0%



Best Practices:

1. Understanding of different work cultures helps bring in sense of diversity and new ideas to work place.

2. Cross cultural meetings and quarterly meetings

3. Emphasize on low cost awareness such as brochures, small punch-lines and hoarding.

4. Avoid words, phrases or idioms that defile others' cultural values.

5. Arranging common orientation programs.

6. Share public information about all team members like birthdays, social events etc.

7. Free lunch and other meets providing and distributing ethnic foods of various cultures.

8. Cultural awareness day encouraging dressing ethnic dresses and food exchanges.

9. Organizing short exchange visits and language programs for learning other team cultures and mentality.

10. Organize campaigns to remove ethno-centric bias and encourage organizations own cultural trend and work ethics.

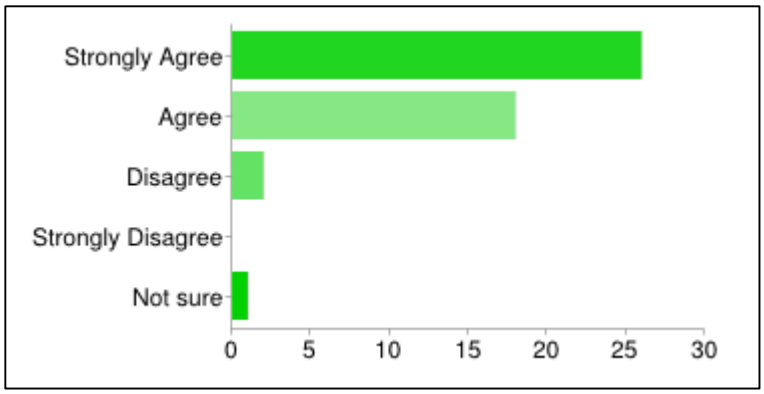
11. State clients work schedules so as to avoid meetings on regional and national holidays of and weekends of other teams.

Factor 6: Trust Building

Knowledge Area: Human Resource Management

Strongly Agree	**26**	55%
Agree	**18**	38%

Disagree	**2**	4%
Strongly Disagree	**0**	0%
Not sure	**1**	2%



Best Practices:

1. Rewards and accolades should be given on time.

2. Equal opportunity for competition to all employees.

3. Build trust by using recognizing contributions and work commitments. Provide bonuses to increase peer competition and accolades.

4. At organization level, certifications like SPI can greatly improve trust over clients.

5. All project members' decision should be respected.

6. Delegate decisions to related members and team leaders "no one man show" - Cut middle man.

7. Activities which encourage trust building should be held - playing ludo in teams, football, Carroms, Bluff, etc.

8. Conducting weekly games and competitions can raise employee spirits.

9. Know your personal weaknesses and mitigate them at the beginning of the project. Send review documents out well in advance of a review meeting.

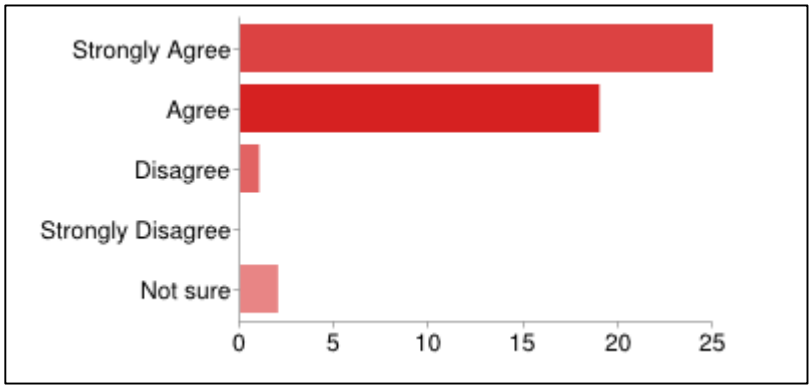
10. Develop a third eye that watches out for risks.

11. All team members should trust higher officials and vice-versa.

Factor 7: Collaboration

Knowledge Area: communication

Strongly Agree	**25**	53%
Agree	**19**	40%
Disagree	**1**	2%
Strongly Disagree	**0**	0%
Not sure	**2**	4%



Best Practices:

1. Use voice communication and high bandwidth technology.

2. Common workbench or work board.

3. Use video tools with file sharing features and dynamic message boards.

4. Persuasion and encourage of use of VARK (Visual, Auditory, Reader, Kinesthetic learning style analysis)

5. Collaboration with MNCs for corporate social responsibility

6. Accurate and adequate collaboration tools avoiding wastage or incumbency.

7. All team members including customer should collaborate.

8. Collaborative tools include various design coding meeting and reporting tools that can be accessed parallel by various teams at different geographic locations providing for parallel project completion and issue monitoring.

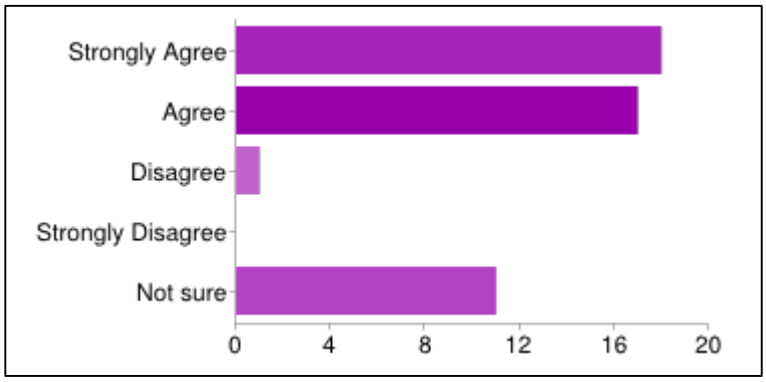
9. Clearly allocated responsibilities and interfaces promote transparency and currency of information, thus ensuring improved planning reliability and quality.

10. Common organization wide communication platform for recording, replaying and monitoring all communication events.

Factor 8: Work Dynamics

Knowledge Area: Quality

Strongly Agree	**18**	38%
Agree	**17**	36%
Disagree	**1**	2%
Strongly Disagree	**0**	0%
Not sure	**11**	23%



Best Practices:

1. Firing risk should be minimized to gain employee confidence and improve efficiency.

2. Work environment should be employee friendly and he/she should enjoy working.

3. Hierarchy should be experienced and project expertise based instead of personal preferences and bias.

4. Procedures policies and people reflect the organization structure. The higher the quality of process used, the skilled the professionals hired the better is the end product quality.

5. Use consistent organizational architecture with team architecture

6. Define how targets will be achieved via a step by step process.

7. Dynamic work environment should not jeopardize member's social life.

8. Use dynamic work structure adjusting to project requirements at the same time being robust and immune to volatility.

9. Good team dynamics start with an effective project manager. As the owner and leader of your company, it is up to you to define the nature of your team through smart staffing, positive guidance and fair dispute resolution.

10. Some types of team-building games and exercises are designed to improve group dynamics and help employees work together more productively.

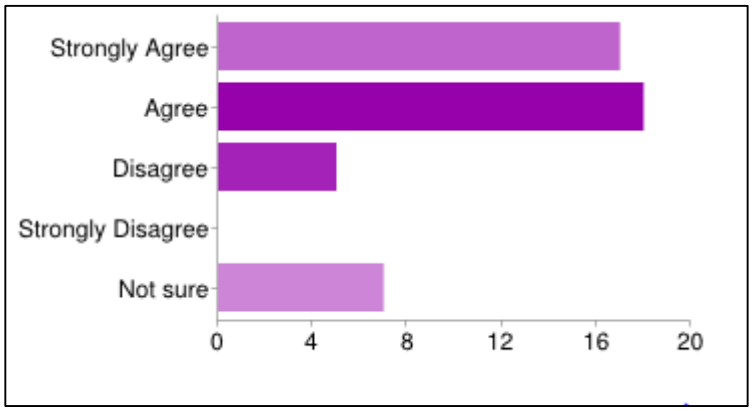
11. Good group dynamics can increase business efficiency and decrease the amount of time lost to conflict and stress.

12. Follow best practices of Project Management like PMI or PRINCE2.

Factor 9: Shared Knowledge

Knowledge Area: Communication

Strongly Agree	**17**	36%
Agree	**18**	38%
Disagree	**5**	11%
Strongly Disagree	**0**	0%
Not sure	**7**	15%



Best Practices:

1. Common centralized database repository.

2. Knowledge across various domains helps a stakeholder get a clear understanding of the project's current status and future scopes.

3. Find time (daily scrum meeting f.i.) that people can talk about what they do and know.

4. Use web based tools to keep a track of project activities.

5. Many organizations deem business solution or project objective as a shared knowledge parameter and work towards arriving at it.

6. Appreciative enquiry is a step towards knowledge share.

7. Start of Knowledge management centre or KPO specific to projects and ISOs.

8. Sharing is not always caring esp. company info. Proper channel of sharing information must be kept while preventing leakages and idle gossips.

9. Should support remote location access of repositories as well with distributed data backups.

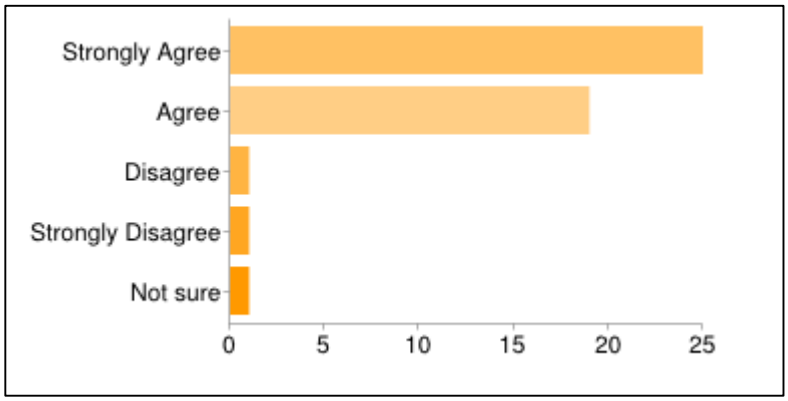
10. Lessons learned should be registered all the time. - Practice sessions to share problems and their resolution.

11. Logging all the data transfer in tape records.

Factor 10: Team commitment and structure

Knowledge Area: Communication

Strongly Agree	**25**	53%
Agree	**19**	40%
Disagree	**1**	2%
Strongly Disagree	**1**	2%
Not sure	**1**	2%



Best Practices:

1. Team management index should be a strong guide towards team configuration and commitment.

2. Team should have high hopes and motivation towards their work. Employee benefits and individual employee care greatly adds to work commitment of every individual towards the project.

3. All team should be focussed towards one goal.

4. Inculcating a “You! Can do it man” attitude into all team members.

5. All team should have a common goal and their roles should be defined with set targets.

6. Define clear roles and responsibilities requests clear structure and carrier path

7. Entire team should belief and follow the given protocols.

8. All team members of same peer level should have common perks to remove bias.

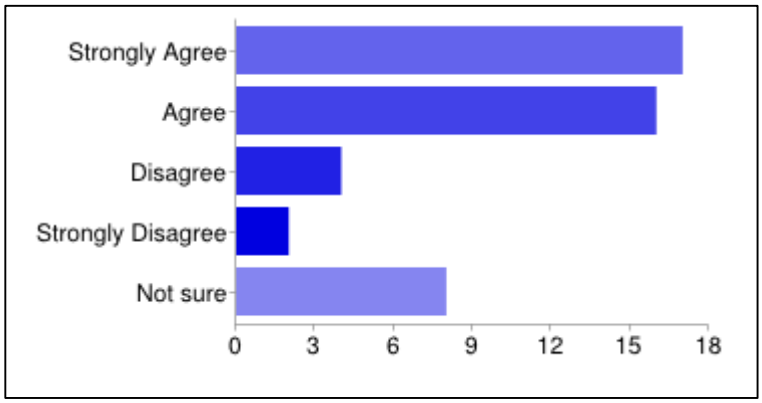
9. It is plausible to suppose that a team that follows 'best practices' in terms of form and structure would have a positive impact on one's sense of personal efficacy to the extent that these structures support higher levels of performance and success on the job.

10. All teams should be collaborating at various levels and running parallel to one another.

Factor 11: Time zone awareness

Knowledge Area: Communication

Strongly Agree	**17**	36%
Agree	**16**	34%
Disagree	**4**	9%
Strongly Disagree	**2**	4%
Not sure	**8**	17%



Best Practices:

1. Meetings should be arranged in a way as they are convenient for all the teams in the process.

2. Good to stay updated and in-tune with the time-zone to get the work done in time and without any inconvenience to the clients.

3. Time management Index

4. Respect rest time and holidays in other countries.

5. Synchronized work hours leading to a Follow-the-sun kind of development.

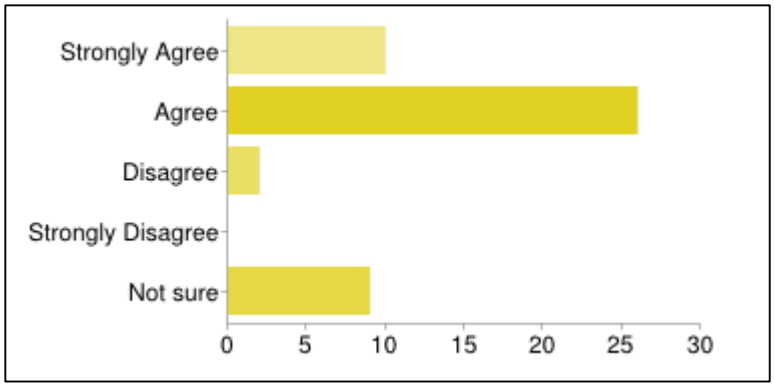
6. Can arrange meetings after once confirmation of time.

7. All work should be synchronized as such parallel development and testing is being carried across various geographies.

Factor 12: Cost assessment

Knowledge Area: Cost

Strongly Agree	**10**	21%
Agree	**26**	55%
Disagree	**2**	4%
Strongly Disagree	**0**	0%
Not sure	**9**	19%



Best Practices:

1. Should hire expert accountants and money managers.

2. Might require proper planning and complete cost analysis.

3. A typical project costs must be carefully evaluated and documented.

4. All cost estimation are performed by higher/senior account management officials and consultants. Hence highly experienced money managers, CA, CAWS, MBAs and consultants should be hired.

5. Contingency should be in terms of back-up resources and current asset worth.

6. Learning from past projects also provides a guideline.

7. Estimate effort and cost for the change and take approval to proceed further.

8. Prepare and review base estimate Determine Risks and Set Contingency

9. Determine Estimate Communication Approach

10. Obtain Management Endorsement

9. Never miss buffers or usage without announcements.

10. Accounting teams should handle cost requirements skilfully.

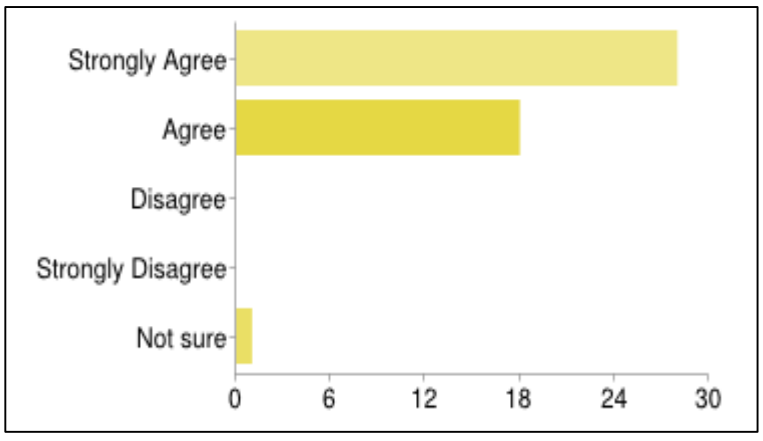
11. Stocks and inventory cost reduction with proper maintenance scheduling.

12. Develop action plans against hidden costs and implement them.

Factor 13: Roles and responsibilities

Knowledge Area: Human Resource Management

Strongly Agree	**28**	60%
Agree	**18**	38%
Disagree	**0**	0%
Strongly Disagree	**0**	0%
Not sure	**1**	2%



Best Practices:

1. All team members on-board should be assigned set of responsibilities and should be provided appropriate tools.

2. All road-blocks in path should be detailed and cleared.

3. Regular status checks and progress assessments should be carried out of all the team members to determine the project's current situation.

4. Deviation from set objective should be monitored and contoured.

5. Roles have to be defined in conjugation with the experience and skill level of the project team members. Also roles are limited to tool availability hence should be designed based upon current resource structure.

6. As a general rule, the PM must be capable of effectively interacting with people. This involves having leadership, communication, negotiation, and team building skills.

7. A successful PM needs to be prepared to resolve conflict and to demonstrate interpersonal communication skills.

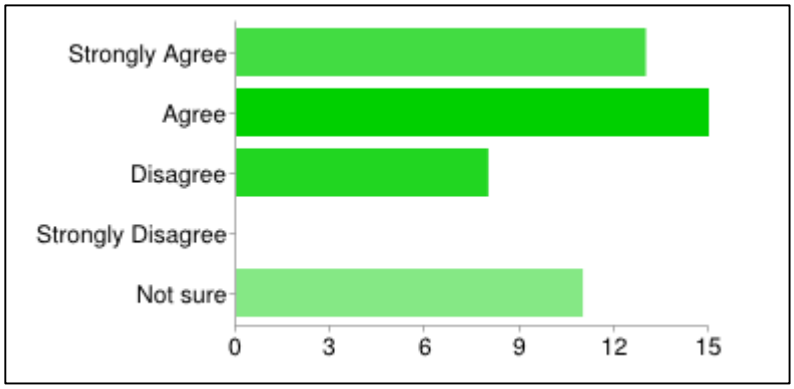
8. RACI and RACI all the time. - If one miss work others should cover.

9. Roles need to include clear objective declarations to avoid bias and preserve transparency.

Factor 14: Shared goals

Knowledge Area: Stakeholder

Strongly Agree	**13**	28%
Agree	**15**	32%
Disagree	**8**	17%
Strongly Disagree	**0**	0%
Not sure	**11**	23%



Best Practices:

1. Make sure to be one team not multi-teams so all should work to have project goals

2. Shared goals should only be dependent upon the type of goal being shared.

3. Team members should resolve the conflicts under the guidance of PM.

4. Team members should have a common goal of achieving project objective irrespective of any personal obligation.

5. Writing "SMART" Goals: Whether you are writing operational or developmental goals, well defined goals

6. "SMART" characteristics: Specific: Describing in precise terms what will be done Measurable: Describing how you will know whether or not the goal was met Achievable: Defining a goal that is challenging but attainable Relevant: Connecting and aligning the employee's role with the objectives of the school/unit Time-bound: Specifying the time frame within which the goal should be completed.

7. Share project goals with teams on all locations.

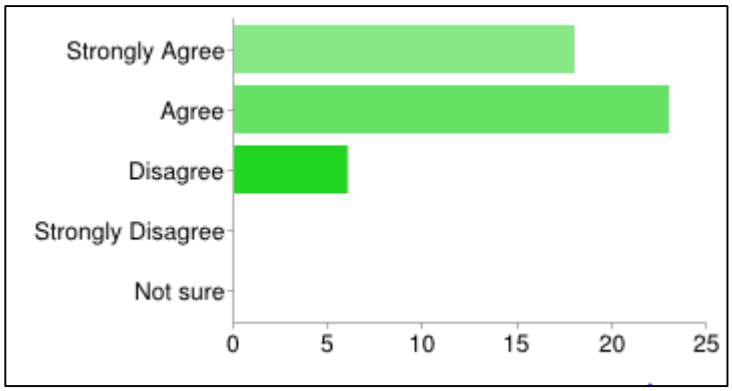
8. Quality assurance and profitability with customer satisfactions.

9. Clear idea of project completion time and date.

Factor 15: Customer awareness

Knowledge Area: Stakeholder

Strongly Agree	**18**	38%
Agree	**23**	49%
Disagree	**6**	13%
Strongly Disagree	**0**	0%
Not sure	**0**	0%



Best Practices:

1. All customer stakeholders should be aware.

2. Provide clean communication channels with customers.

3. Reference to consultants and survey magazines can help estimate current trends and customer requirements.

4. Frequent stakeholder meetings but avoiding complete stakeholder involvement in development process.

5. Conduct customer surveys for understanding preferences.

6. Study market competition.

7. Share awareness & collect feedback from committee and social networks.

8. More focused towards mobile and cloud platforms.

9. More we understand the customer requirement the better we are able to deliver the product.

10. A study by other survey/consulting firms and magazines can give a clear marking of current/trending market scenarios and customer requirements.

11. In gaming industry, Customer are the essence of any game or profit factor. Hence customer should be heavily involved during storyboard creation and alpha, beta testing stages.

12. Product development is driven by prior product line experience and feedback from various third party user sites and blogs.

13. Provide feedbacks, questionnaire and surveys to common public to get idea about future or next updates.

14. RCs are guide to capture changing customer requirements and preferences.

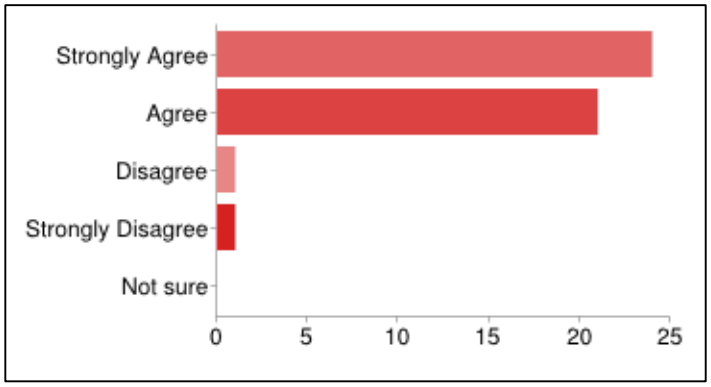
15. Brand Awareness & Customer Satisfaction before and after buying - 0bligations/rights/duties.

16. Open market near customers.

Factor 16: Training

Knowledge Area: Human Resource Management

Strongly Agree	**24**	51%
Agree	**21**	45%
Disagree	**1**	2%
Strongly Disagree	**1**	2%
Not sure	**0**	0%



Best Practices:

1. Training should be effective and propel people for gearing for real time project.

2. Prepare comprehensive and meaningful training programs.

3. Should be given by hugely experienced corporate trainers.

4. Better and higher quality training docs, the better the employees are ready for the real-time project.

5. Never waste time with un-valued training courses. - do training in proper time and for suitable members.

6. Training should be conducive to the work pattern of the organization and specific to project objective to avoid time wastage and money resources.

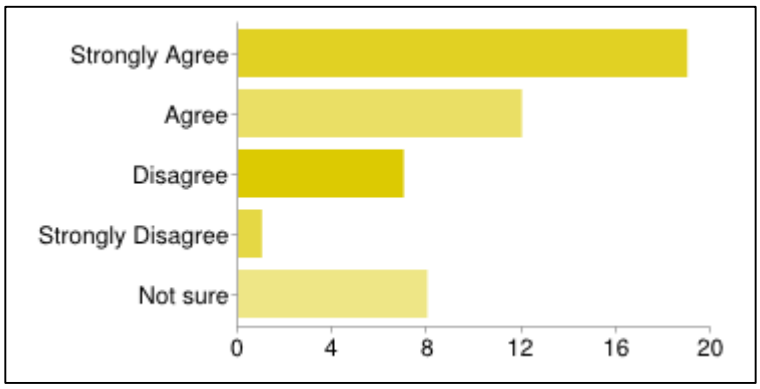
7. Training documents should be ISO 9026 certified and should be apt to project requirement.

8. Trainings generally help project managers grasp the intricacies of control, quality and management.

Factor 17: Time to delivery

Knowledge Area: Time

Strongly Agree	**19**	40%
Agree	**12**	26%
Disagree	**7**	15%
Strongly Disagree	**1**	2%
Not sure	**8**	17%



Best Practices:

1. Quicker the better but quality can't be compromised.

2. Monitoring Tools and strategies.

3. Again fewer development cycles, lesser is the time to market. Weekly progress updates from all teams and feedback exchanges.

4. With increase market competition, all products in the product line should have a very small time to market with focus on frequent update policy.

5. Login system to check how much time an employee is spending on particular task.

6. During the life cycle of a project, some unexpected crises may occur due to factors such as labor strikes, recession, funds shortage and natural calamities. In such situations, a project manager is always called upon to display utmost maturity and profound managerial skills in handling the issues.

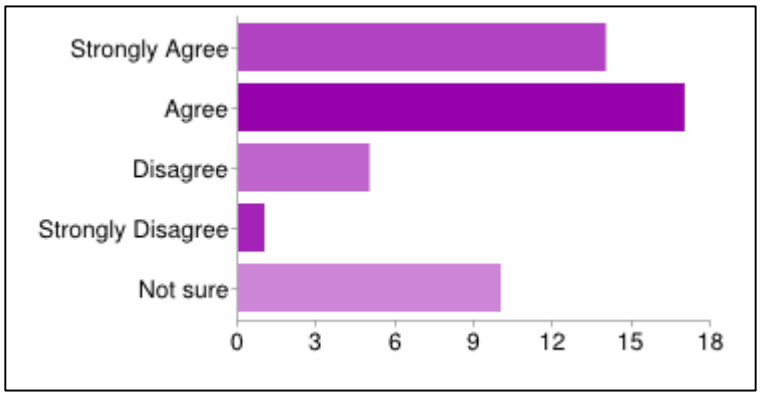
7. Employee work efficiency improvement plans like PIP and other performance improvement plans.

8. Time based incentives-Faster delivery time, more bonus or rewards.

Factor 18: Incremental cycles

Knowledge Area: Time

Strongly Agree	**14**	30%
Agree	**17**	36%
Disagree	**5**	11%
Strongly Disagree	**1**	2%
Not sure	**10**	21%



Best Practices:

1. Use incremental approach for development.

2. Frequent and meaningful updates.

3. Projects running for long duration have all requirements defined earlier and hence are staged instead of incremental by nature.

REFERENCES

[1] S. U. Khan, M. Niazi, and R. Ahmad, "Critical Success Factors for Offshore Software Development Outsourcing Vendors: A Systematic Literature Review," in *Global Software Engineering, 2009. ICGSE 2009. Fourth IEEE International Conference on*, 2009, pp. 207-216.

[2] A. A. Bush, A. Tiwana, and H. Tsuji, "An empirical investigation of the drivers of software outsourcing decisions in Japanese organizations," *Information and Software Technology,* vol. 50, pp. 499-510, 2008.

[3] M. Ali-Babar, J. Verner, and P. Nguyen, "Establishing and maintaining trust in software outsourcing relationships: An empirical investigation," *The Journal of Systems and Software,* vol. 80, pp. 1438–1449, 2007.

[4] M. Ali-Babar, Verner, J. and Nguyen, "Establishing and maintaining trust in software outsourcing relationships: An empirical investigation," *The Journal of Systems and Software 80 (9). (2007) 1438–1449,* 2007.

[5] L. McLaughlin, "An eye on India: outsourcing debate continues," *Software, IEEE,* vol. 20, pp. 114-117, 2003.

[6] S. U. Khan, M. Niazi, and R. Ahmad, "Factors influencing clients in the selection of offshore software outsourcing vendors: an exploratory study using a systematic literature review," *Journal of Systems and Software,* vol. 84, pp. 686-699, 2011.

[7] D. Damian, L. Izquierdo, J. Singer, and I. Kwan, "Awareness in the Wild: Why Communication Breakdowns Occur," in *International Conference on Global Software Engineering*, 2007, pp. 81-90.

[8] B. Shao, David, J.S., "The impact of offshore outsourcing on IT workers in developed countries.," *Communications of the ACM,* vol. 50, pp. 89 - 94, 2007.

[9] A. Stetten, v., D. Beimborn, E. Kuznetsova, and B. Moos, "The Impact of Cultural Differences on IT Nearshoring Risks from a German Perspective," in *in Proceedings of the 43rd IEEE Hawaii International Conference on System Sciences*, 2010.

[10] I. Business Monitor, "Saudi Arabia Information Technology Report, Q1 2011," p. 56, Feb. 2011 Feburary 2011.

[11] O. S. A.-A. Mohammed Sadiq Sohail, (2005) "The usage of third party logistics in Saudi Arabia: Current position and future prospects", International Journal of Physical Distribution & Logistics Management, Vol. 35 Iss: 9, pp.637 - 653.

[12] "S. Setamanit, W. Wakeland, and D. Raffo, “Improving Global Software Development Project Performance Using Simulation,” in Management of Engineering and Technology, Portland International Center for, 2007, pp. 2458–2466.

."

[13] E. i. t. o. r. t. a. p. “T. Kern and L. Willcocks, ’ Journal of Strategic Information Systems, vol. 9, pp. 321-350, 2000.”.

[14] F. s. t. a. p. a. i. G. S. D. G. A. Tariq and A. A. Khan, ” in 2012 International Conference on Emerging Technologies (ICET), 2012, pp. 1–6.

[15] T. N. “Arttu Piri, Casper Lassenius, ‘Descriptive Analysis of Fear and Distrust in Early Phases of GSD Projects’, Fourth IEEE International Conference on Global Software Engineering 2009, pp. 105-114.”.

[16] M. N. “S. Khan, and R. Ahmad, ‘Critical Success Factors for Offshore Software Development Outsourcing Vendors: A Systematic Literature Review,’ in The 4th IEEE International Conference on Global Software Engineering, Ireland, 2009.”.

[17] T. C. “P. A. Laplante, P. Singh, S. Bindiganavile, and M. Landon, ‘ The who, what, why, where, and when of IT outsourcing,’ IEEE IT Professional, vol. 6, pp. 19 - 23, 2004.”.

[18] T. a. s. g. t. t. n. e. “M. S. Hopkins, ’ Inc. 20,1, pp. 36-45, 1998.”.

[19] C. o. g. s. d. o. v. n. “E. Carmel and P. Abbott, ’ in International Conference on Software Engineering, Shanghai, China, 2006, pp. 3 - 7.”.

[20] A. e. e. o. c.-v. r. i. I. s. o. c. “N. V. Oza, ’ PhD thesis, School of Computer Science, University of Hertfordshire, UK, 2006.”.

[21] M. “M. Minevich and F. J. Richter. (2005, 2008). Global Outsourcing Report, http://globalequations.com/Global%20Outsourcing%20Report.pdf.”.

[22] A. I. O. R. a. A. a. M. C. a. V. “M. J. Gallivan and W. Oh, ’ in Proceedings of the 32nd Hawaii international Conference on System Sciences, Hawaii, USA, 1999.”.

[23] M.-.-u. i. t. t. c. u. w. r. a. e. o. w. i. p. “L. Obal, ’ in Proceedings of the 2006 ACM SIGMIS CPR conference on computer personnel research: Forty four years of computer personnel research: achievements, challenges & the future, Claremont, California, USA, 2006, pp. 60 - 62.”.

[24] C. W. “D. Smite, T. Gorscheck, and R. Feldt, ‘Empirical evidence in global software engineering: a systematic review,’ Empirical Software Engineering, vol. 15, pp. 91-118, 2010.”.

[25] D. Smite, C. Wohlin, T. Gorscheck, and R. Feldt, "Empirical evidence in global software engineering: a systematic review," *Empirical Software Engineering,* vol. 15, pp. 91-118, 2010.

[26] L. W. “L. Layman, D. Damian, and H. Bures, ‘Essential communication practices for Extreme Programming in a global software development team,’ Information and software technology, vol. 48, no. 9, p. 781, 2006.”.

[27] D. a. s. d. a. r. “S. V. Shrivastava and H. Date, ’ Journal of Computer Science and Engineering, vol. 1, no. 1, May. 2010.”.

[28] L. I. “D. Damian, J. Singer, and I. Kwan, ‘Awareness in the Wild: Why Communication Breakdowns Occur,’ in International Conference on Global Software Engineering, 2007, pp. 81-90.”.

[29] S. G. S. D. “C. Ebert and P. De Neve, ’ IEEE Software, Vol. 18, No. 2, 2001, pp. 62 - 69.”.

[30] H. H. E. O’Conchuir, P. J. Agerfalk, and B. Fitzgerald, “Exploring the Assumed Benefits of Global Software Development,” in International Conference on Global Software Engineering, 2006. ICGSE ’06, 2006, pp. 159–168.

[31] M. M. J. “S. Islam, Alam , and S. Houmb, Hilde, ‘Goal and Risk Factors in Offshore Outsourced Software Development from Vendor’s Viewpoint,’ in Fourth IEEE International Conference on Global Software Engineering, 2009, pp. 347-352.”.

[32] G. S. D. P. R. a. S. “M. Bass and D. Paulish, ’ in International Workshop on Global Software Development. Edinburgh, Scotland, 2004.”.

[33] A. M. “J. D. Herbsleb, T. A. Finholt, and R. E. Grinter, ‘Distance, dependencies, and delay in a global collaboration,’ Proc. 2000 ACM conference on Computer supported cooperative work, Philadelphia, Pennsylvania, United States, 2000.”.

[34] T. E. o. T. S. o. C. C. i. G. S. T. A. D. M. “J. A. Espinosa and E. Carmel, ’ Proc. 37th Hawaiian International Conference on System Sciences, Big Island, Hawaii, 2004.”.
[35] R. M. i. G. S. D. P. C. J. Munch, Solutions, and Experience,” in 2011 Sixth IEEE International Conference on Global Software Engineering Workshop (ICGSEW), 2011, pp. 35–35.
[36] R. f. o. o. f. I. o. “D. Foote, people issues,’ ABA Banking Journal, vol. 96, pp. 56-59, 2004.”.
[37] J. “ITWeek. (2004) Firms take outsourcing risks. IT Week, 14.”.
[38] A. C. “K. Nam, R. Rao, and R. H., S., ‘ A Two-Level Investigation of Information Systems Outsourcing,’ Communications of ACM, vol. 39, pp. 36-44, 1996.”.
[39] M. a. K. C. K. Christel, "Issues in Requirements and E. T. R. CMU/SEI-92-TR-OI2.
[40] C. S. Tang and a. J. D. Zimmerman, "Managing New Product

Development and

Supply Chain Risks:

The Boeing 787 Case," *Supply Chain Forum*.
[41] O. b. m. c. “W. King, ’ IT Strategy and Innovation - ISM Journal, pp. 89 - 90, 2005.”.
[42] S. D. “B. Aubert, M. Patry, and S. Rivard, Managing the risks of IT outsourcing, 1998.”.
[43] S. c. i. o. I. s. “J. Blackley and J. Leach, ’ Information Security Technical Report, 1(3), pp. 11 - 17, 1996.”.
[44] J. G. “R. Gonzalez, and J. Llopis, ‘Information systems outsourcing risks: a study of large firms,’ Industrial management and data systems, vol. 105, pp. 45–62, 2005.”.
[45] A.-b. “P. Nguyen, M and Verner, June., ‘Trust in software outsourcing relationships: an analysis of Vietnamese practitioners’ views.,’ in EASE, 2006, pp. 10-19.”.
[46] T. r. o. t. i. o. I. d. p. “R. Sabherwal, ’ Communication of ACM, vol. 42, pp. 80-86, 1999.”.
[47] T. M. Rajkumar and D. L. Dawley, "Problems and issues in offshore development of software," *Strategic sourcing of Information Systems: Perspectives and Practices, Wiley Series in Information Systems,* pp. 369-386, 1997.
[48] N. Khan, W. L. Currie, V. Weerakkody, and B. Desai, " Evaluating offshore IT outsourcing in India: supplier and customer," in *System Sciences, 2003. Proceedings of the 36th Annual Hawaii International Conference*, Hawaii, 2003.
[49] S. Sakthivel, *Communication of the ACM,* vol. 50, 2007.
[50] L. Charalambos, Iacovou and N. Robbie, "A risk profile of offshore-outsourced development projects," *Communications of the ACM,* vol. 51, pp. 89-94, 2008.
[51] R. Narayanaswarmy and R. M. Henry, "Effects of culture on control mechanisms in offshore outsourced IT projects," in *Proceedings of the 2005 ACM SIGMIS CPR conference on Computer personnel research*, Atlanta, Georgia, USA, 2005, pp. 139 - 145.
[52] B. Aubert, J.-F. Houde, M. Patry, and S. Rivard, "Characterestics of IT Outsourcing Contracts," in *Proceedings of the 36th Hawaii International Conference on System Sciences*, 2003.

[53] S. Barney, C. Wohlin, G. Hu, and A. Aurum, "Creating Software Product Value in China," *IEEE Software, July/August,* vol. 26, 2009.

[54] C. Jahns, E. Hartmann, and L. Bals, "Offshoring: Dimensions and diffusion of a new business concept," *Journal of Purchasing and Supply Management,* vol. 12, pp. 218-231, 2006.

[55] T.-C. Chou, J.-R. Chen, and S. L. Pan, "The impacts of social capital on information technology outsourcing decisions: A case study of Taiwanese high-tech firm," *International Journal of Information Management,* vol. 26, pp. 249-256, 2006.

[56] R. Hanna and T. Daim, "Critical Succes Factors in Outsourcing: Case of Software Industry," in *IEEE conference PICMET 2007, USA*, 2007.

[57] D. Bradstreet. (2000, September). *Dun & Bradstreet's Barometer of Global Outsourcing*. Available: http://findarticles.com/p/articles/mi_m0EIN/is_2000_Feb_24/ai_59591405

[58] J. Stark, M. Arlt, and D. Walker, H. T., "Outsourcing Decisions and Models - Some Practical Considerations for Large Organizations," in *International Conference on Global Software Engineering*, 2006, pp. 12-17.

[59] M. Cataldo, M. Bass, Herbsleb, J. D., and L. Bass, "On Coordination Mechanisms in Global Software Development," in *International Conference on Global Software Engineering*, 2007, pp. 71-80.

[60] L. Mary and R. Joseph, "Effects of offshore outsourcing of information technology work on client project management," *Strategic Outsourcing: An International Journal,* vol. 2, pp. 4-26, 2009.

[61] S. Khan, M. Niazi, and R. Ahmad, "Critical Success Factors for Offshore Software Development Outsourcing Vendors: A Systematic Literature Review," in *The 4th IEEE International Conference on Global Software Engineering*, Ireland, 2009.

[62] D. Smite, C. Wohlin, T. Gorscheck, and R. Feldt, "Empirical evidence in global software engineering: a systematic review," *Empirical Software Engineering,* vol. 15, pp. 91-118, 2010.

[63] R. Heeks, S. Krishna, B. Nicholson, and S. Sahay, "Synching or Sinking: Global Software Outsourcing Relationships," *IEEE Software,* vol. March/ April 2001, pp. 54-60, 2001.

[64] N. V. Oza, T. Hall, A. Rainer, and S. G. Grey, "Trust in software outsourcing relationships: An empirical investigation of Indian software companies," *Information & Software Technology,* vol. 48, pp. 345-354, 2006.

[65] H. Holmstrom, E. Ó. Conchúir, P. Ågerfalk, and B. Fitzgerald, "Global Software Development Challenges: A Case Study on Temporal, Geographical and Socio-cultural Distance," in *International Conference on Global Software Engineering*, 2006, pp. 3-11.

[66] M. Ali-baber, J. Verner, and P. Nguyen, "Establishing and maintaining trust in software outsourcing relationships: An empirical investigation," *The Journal of Systems and Software,* vol. 80, pp. 1438–1449, 2007.

[67] B. Kitchenham and C. Charters, "Guidelines for performing Systematic Literature Reviews in Software Engineering," Keele University and Durham University Joint Report - EBSE 2007-001 EBSE 2007-001, 2007.

[68] J. Binder, *Global project management – communication, collaboration and management across borders*: Gower, 2010.

[69] H. K. Edwards and V. Sridhar, "Analysis of the effectiveness of global virtual teams in software engineering projects," in *System Sciences, 2003. Proceedings of the 36th Annual Hawaii International Conference on*, 2003, p. 9 pp.

[70] J. Noll, S. Beecham, and I. Richardson, "Global software development and collaboration: barriers and solutions," *ACM Inroads,* vol. 1, pp. 66-78, 2011.

[71] M. Jensen, S. Menon, L. E. Mangset, and V. Dalberg, "Managing Offshore Outsourcing of Knowledge-intensive Projects - A People Centric Approach," in *Global Software Engineering, 2007. ICGSE 2007. Second IEEE International Conference on*, 2007, pp. 186-196.

[72] S. U. Khan, M. Niazi, and R. Ahmed, "An empirical investigation of success factors for offshore software development outsourcing vendors," *IET Software,* vol. 6, pp. 1-15, 2012.

[73] M. C. Lacity and J. W. Rottman, "The Impact of Outsourcing on Client Project Managers," *Computer,* vol. 41, pp. 100-102, 2008.

[74] A. Välimäki, J. Kääriäinen, and K. Koskimies, "Global Software Development Patterns for Project Management

Software Process Improvement." vol. 42, R. V. O'Connor, N. Baddoo, J. Cuadrago Gallego, R. Rejas Muslera, K. Smolander, and R. Messnarz, Eds., ed: Springer Berlin Heidelberg, 2009, pp. 137-148.

[75] B. Lutz, "Linguistic Challenges in Global Software Development: Lessons Learned in an International SW Development Division," in *Global Software Engineering, 2009. ICGSE 2009. Fourth IEEE International Conference on*, 2009, pp. 249-253.

[76] T. Clear, W. Hussain, and S. G. MacDonell, "The Many Facets of Distance and Space: The Mobility of Actors in Globally Distributed Project Teams," in *Global Software Engineering (ICGSE), 2012 IEEE Seventh International Conference on*, 2012, pp. 144-148.

[77] P. Bannerman, E. Hossain, and R. Jeffery, " Scrum Practice Mitigation of Global Software Development Coordination Challenges: A Distinctive Advantage?," in *45th IEEE International Conference on System Science (HICSS)*, 2012, pp. 5309 - 5318.

[78] Ferna, x, L. ndez-Sanz, and S. Misra, "Analysis of cultural and gender influences on teamwork performance for software requirements analysis in multinational environments," *Software, IET,* vol. 6, pp. 167-175, 2012.

[79] Z. Dexia, "Evaluation on the Competitiveness of Chinese Firms Participating in Offshore Service Outsourcing - A Preliminary Assumption," in *Management and Service Science, 2009. MASS '09. International Conference on*, 2009, pp. 1-4.

[80] V. Casey, "Leveraging or Exploiting Cultural Difference?," in *Global Software Engineering, 2009. ICGSE 2009. Fourth IEEE International Conference on*, 2009, pp. 8-17.

[81] D. S. B. i. A. A. B. o. S. r. "Trewin, http://www.ausstats.abs.gov.au/Ausstats/subscriber.nsf/0/C639A01ED725ADABCA256C54000336D1/$File/13210_2001.pdf, June 2005.,"

[82] M. K. Daskalantonakis, "A practical view of software measurement and implementation experiences within Motorola," *Software Engineering, IEEE Transactions on,* vol. 18, pp. 998-1010, 1992.

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